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A Year of the Monthly Edition.

At the beginning of the year we promised those who subscribed for the first of each month's issues only that we would give them at least 400 pages of reading matter devoted to machine-shop matters, and that the articles and letters to be presented in these pages should be especially adapted to the needs of shopmen—those who in some way perform the labor of making the parts of machinery and putting them together. We asked our readers to co-operate with us in the work of making this an entirely satisfactory medium of exchange for ideas and experience pertaining to shop matters and promised to do our part in the work. The result has been more than gratifying. About 480 pages of reading matter have been presented in these twelve numbers. Nearly every line printed in these 480 pages has had for its object the telling of shopmen how things were done or how things had been done in shops here and abroad and what kind of shops and equipment these things were being done in and with.

About 430 "Letters from Practical Men" have been printed in these twelve numbers and these, with the engravings accompanying them, have occupied nearly 200 pages or about 590 columns. These letters have come from machine constructors and are addressed to those who build machinery. Every one of them, we believe, has been of use to some of our readers and many of them have placed ideas, methods and tools upon record for the first time. From the cupola and core-room to the erecting floor and warehouse, additional light has been thrown upon the methods of machine building establishments. The interest shown by foreign readers and contributors is especially noticeable. A goodly proportion of the contributions have come from Britain and not a few from Continental countries. We need hardly say that we welcome a good idea from any country and believe in the beneficent effect of the general interchange of ideas.

The monthly edition of the "American Machinist" already has a large list of readers, and we believe this list will continue to grow. No paper that covers machine building processes can make every article useful or interesting to every reader, but by setting apart the first issue in every month especially for those who actually do the manipulative work in machine shops, while to the other issues we relegate those things that more particularly interest the draftsman, the designer, the engineer or the office man, we are enabled to come much nearer making every article useful to every reader than is possible where each issue must be considered or be hoped to be adapted to all who are in any way connected with machine construction.

While no startling innovations are contemplated for the coming year we shall probably make some improvements and shall in fact be always on the lookout for opportunities to make them.

A Practical Lesson in Smokelessness

It is planned by the managers of the St. Louis Exposition of 1903 to make it a practical demonstration of the fact that the burning of soft coal can be done without smoke. The Smoke Abatement Association of St. Louis has taken hold of the matter with the approval and co-operation of the directors. Not only is the entire exhibition to be smokeless, but the railroads running trains to the exposition will be urged to adopt smoke-consuming devices for their locomotives. This is a most practical idea, and if it can be carried out successfully a service will be rendered to the country greater than such exhibitions are usually credited with. It will be doing what at the present time is eminently necessary to be done, for while there is a movement throughout the West to abate the smoke nuisance, it is hindered and retarded by the coal users with the contention that smokeless combustion is not possible. If it is once shown that it is possible on such a scale as would be involved in the supply of power and light for the entire exposition, and if all the visitors to the exposition can be convinced of it, then smokelessness will be insisted on elsewhere and everywhere. It is much to be feared, however, that the smokelessness will be comparative rather than absolute. Smokelessness to the eyes and other senses of the citizen of St. Louis or of Chicago would probably be a rather different thing from the smokelessness of the New Yorker. The thing to be ultimately insisted upon is not merely the smokeless burning of soft coal, but smokelessness whether or no. If the coal cannot be, or if the users of it will not arrange for it to be, burnt without smoke, then let the public insist upon other arrangements. Let the coal that is consumed for light and power be burnt elsewhere than throughout the large cities, and let the transmission be by electric-current, and for the other incidental and domestic uses of coal let gas or coke be employed. As Mr. Tecumseh Swift has already suggested in our columns, it would seem to be perfectly possible to establish electric generating plants at the almost inexhaustible mines of, say, Central Illinois, and to transmit current sufficient to supply the light and power needs of St. Louis and Chicago and all the smaller towns of the region. Where the distances are too great for electric transmission, power houses may be located, say, twenty miles from a city, or even ten miles, and the coal may be brought and used there. Arrangements of this character may be gone into with the result of greater economy in the use of the coal, a matter which is well worth considering now, as it is likely to become imperative later. Smokelessness is a luxury which New Yorkers enjoy and appreciate. Like all luxuries, it is bound to spread until the common people everywhere shall enjoy it. The wonder is that the smoke nuisance is tolerated as it is, and if the St. Louis Exposition can show that the people living in smoke need no longer do so, and can get them to realize how delightful it is to live without the smoke, then the smoke will have to go. The people need no longer be in the attitude of tamely enduring a nuisance upon the unwarranted assumption that it cannot be cured.

The British Westinghouse Establishment.

Great progress is being made with the great factory which the Westinghouse Engineering and Manufacturing Company, in the course of its invasion of England, is building at Manchester. It is to be an immense hive of British industry directed by American brains.

The enormous building which is being reared in Trafford Park is so far advanced that one can form some idea of the magnitude it will assume when completed about ten months hence. The buildings alone are to cost nearly £900,000, and the plant that will be laid down is valued at £400,000, so that this will be one of the largest places of business that has ever been erected at the outset of an enterprise.

The new works will belong to the British branch of the Westinghouse business, and will employ 6,000 British workmen when in full working order. At the outset Americans will direct operations, and American methods will be adopted as far as possible. Young English engineers are at Pittsburgh at present learning those methods, that they may help to inoculate their fellow-countrymen with Western ideas on their return.

The construction of the huge buildings is being carried on by British workmen directed by Americans. The Westinghouse Company were anxious to hurry on the question of their works, and they called in Mr. James C. Stuart, of a famous contracting firm in the States, to take charge of the work. He came over two months ago bringing half a dozen young assistants, and they have been engaged in the congenial task of "hustling things along."

Two thousand six hundred British workmen are engaged on the job, and those seven American men reckon to keep each and every one of them going steadily at work every minute of the time that is put down against his name on the time sheet. There is no loafing, smoking, or waiting for bricks. Every single man has something to do and you can see him doing it. There is no shouting or chaff, no hurrying, but steady, quiet progress.

Mr. Stuart and his colleagues have taken quite a liking to the British workman, and they say they are getting more work out of the men than they usually give. All heavy work that can be done by machinery is so performed, and every contrivance that will lighten labor is employed. Wheelbarrows are made lighter by the use of iron—so that more bricks can be carried at each journey. American hoisting engines whisk the barrows up 50 feet in the twinkling of an eye, and bring down others at the same time. Every detail of the work is organized. The scaffolding is always ahead and waiting for the men, and the materials are ready to hand, so that the men never waste a minute in waiting. That is how the "hustling" is done. Men are not driven; they are led.

While the skilled labor is good the common laborer is a comparatively poor creature in the view of these Americans.

The Westinghouse works will be divided into seven great departments under forty acres of roof. The machine shop will cover an area of eight acres. From the north end of this shop to the south end of the joiner house there will be a single stretch of roof 1,156 feet long, and the breadth will be 427 feet. The steel foundry will be nearly two-thirds the size of the machine shop. The iron foundry is to be the same size as that for steel, and the foundry for brass and malleable iron will be half as large. The box factory, pattern shop and dipping house are to be on a corresponding scale, and a fine six-story block of offices will have a frontage of 250 feet.

BUILT ON THE AMERICAN PLAN.

The first step in construction was to set up a vast framework of steel pillars, stanchions and girders, and then this giant skeleton had to be clothed with brick and timber and glass. A contract for 15,000 tons of steel at £18 a ton has been given to a Middlesbrough firm, although the builders say it could have been got cheaper in America. The timber comes from America, and amounts to 9,000,000 feet. Within eight weeks of the order being placed in the States for the window frames some of them were being built into brick walls.

The power to work the machinery will be provided in the first instance by steam engines generating electricity, but after a couple of years gas engines may be introduced in place of steam. All through the grounds tunnels are being laid for the transmission of power.

For transport purposes the works could not be better situated. The Ship Canal is close at hand for goods coming from America and the shipments of machinery to foreign parts. The Bridgewater Canal will bring all the coal. Railway connections are already in existence, and when the work is complete there will be thirty-two miles of permanent lines going through the shops and from one to another and all over the estate.

Another company has undertaken to erect dwellings near the works, and a little village has already sprung up there. The streets are named in American fashion—Third street, Fourth street, and so on. The houses are to be lighted by electricity and heated by gas when the American engineers come along.

Altogether, there will be a pocket edition of Pittsburgh in England.

The above, which we take from an unknown English newspaper, will be interesting to American readers, and we may say further that the organization of the management for the British Westinghouse Electric and Manufacturing Company's works has been in operation for some time past (two years), with headquarters in the office building of the E. Pittsburgh plant.

A corps of one hundred or more English mechanics and engineers, the best that could be obtained, were brought across the water nearly two years ago and placed in the offices and works of the company here, where they have been receiving instructions and training in the methods of American shop practice and management.

Many of the old workmen of English birth who learned their trades in shops of the old country have been added to the list, as well as many of the young American mechanics.

A department known as the British Company toolroom is in operation, where English workmen are working side by side with their American cousins, learning American methods of jig and tool making. This department will be transported complete to the new plant in Manchester, men and tools, as soon as shafting is set ready for pulling the belts.

In every department of the great E. Pittsburgh works of the electric company men are working under special instructions, many of them ready and well trained in the shop routine; so that when the new shops in England are thrown open to receive the English workmen American methods will prevail throughout from the start.

American Locomotives in Bavaria.

United States Consul Frank H. Mason sends from Berlin the following interesting account of the reception accorded some American locomotives:

"The Berlin 'Neuste Nachrichten' of October 29 contains a telegram from Munich concerning the results of the experience of the Royal Railway Administration with American locomotives, of which the following is a translation:

"'The general administration of the Bavarian State Railways ordered and received from the Baldwin Locomotive Works, in Philadelphia, two express passenger locomotives, which have been in use nearly three-fourths of a year. The difference between these locomotives—which are easily recognized by their unearthly whistle—and the German engines consists principally in the fact that they have on each side three cylinders, placed vertically one above the other, and cast in one piece with the valve chests and saddle. In other respects the American machines are characterized throughout by the greatest simplicity in all parts, and their management differs very slightly from that of any other locomotive.'

"Since they were placed in service, the methods in which the steam power acts and the general efficiency of the locomotives have been very carefully observed. The result of all these tests and observations has been entirely satisfactory. The general direction has now, as is announced by the Munich 'Allgemeine Zeitung,' secured the patent of the American Vauclain, and authorized the construction of a locomotive according to this system, with certain modifications, by each of the two

firms Krauss & Co., of Munich, and J. A. Maffei, of Hirschau. These machines are now in process of construction, and it will depend upon their efficiency and durability whether the system shall be further utilized. The cost of the Bavarian locomotives will be about 20,000 marks ($5,760) greater than that of the American."

Commercial Review.

NEW YORK, Monday, Dec. 2.

TOOL AND MACHINE MARKET CONDITIONS.

The machine-tool market for November has held up excellently as compared with October. In a few instances it is hardly reaching as large a total as the earlier month, but taking the average of cases reported there is little if anything to choose. One general machine-tool seller who is not inclined to take an over-optimistic view of conditions and whose trade, by the way of exception from the rule, was poor in September and October, is now able to perceive a distinct betterment in tone. The sources of present demand include railroads, locomotive shops, electrical works, engine shops, etc. The industrial center which above all others forms an exaggerated exponent of the boom is Milwaukee, Wis. About all of the large engine builders of that town and its suburbs are building new plants or enlarging old ones and there is consequently a vast amount of equipment required, although of course the chief shopping ground for it is at points west of New York. The plants thus enlarging are not doing so as a bluff or a speculation but because they are buried up to the top of the chimney stack in orders. This state of affairs is brought out partly by the experience of a man who has lately been seeking to obtain agencies for Asiatic Russia. He has found manufacturers so taken up with their domestic business that they are in no mood to invite an increase of their contractural obligations from other quarters of the world. Akin to the boom among engine builders is the activity among manufacturers of elevating and conveying machinery. An official of one of the large concerns in this line of work characterizes the amount of business as something extraordinary and states that his own company is practically out of the market. About all leading manufacturers in this branch are increasing the capacity of their plants or have recently done so. One Chicago concern which has only lately built a new works is now compelled to make further additions.

Although the West is the industrial Dorado which attracts attention even in New York, it is not to be inferred that the East is slack. A man who has been traveling about a good deal in the New England States remarks that if there is any shop there which is not exceedingly busy it is due to some incorrigible fault in the concern itself.

If there is anything to introduce a discord in the grand, sweet song of industry it is not an insufficiency of business enterprise but overplussage thereof. One is inclined to wonder whether prosperity is not growing to such ponderous dimensions that when it falls it will go down hard. While there is ground, however, to apprehend an overproduction in many lines if new construction keeps on much longer at the present rate, business may be congratulated upon the apparent absence of elements of financial weakness such as that which largely contributed to Germany's industrial depression. Further, it is a good sign that manufacturers in the mechanical lines are showing such admirable self-control in respect to prices, and by refraining from advancing these as fast as the market will bear it, are helping to obviate the demoralizing cuts that must else be made as soon as the volume of trade grows less. As yet no sign of a business reaction is visible, and it has even been predicted that trade will be still heavier after the first of the year. One tool man, who has good opportunities for observation, predicts that three months from now it will be harder to get satisfactory deliveries of machine tools than it is at present.

The line of automobile manufactures is spoken of with anything but enthusiasm from the tool seller's standpoint.

RAILROAD AND LOCOMOTIVE WORK.

Railroad work stands well in the forefront of machine-tool demand. Among the trunk lines entering New York the Erie is one of those now in the market for tools. Extensive enlargements of this company's equipment have been discussed for a long time past and the machines now in requisition are but a fraction of the whole which is to be expected. The big contract of the New York, New Haven & Hartford in expectation of which sellers have begun to grow gray is now looked for this month. The Lehigh Valley is understood also to be making some purchases.

The Rogers Locomotive Works at Paterson, N. J., recently organized as successor to the Rogers Locomotive Company, is reported to have completed plans for an extension of the shops that will enable the company to turn out forty-five locomotives a month, double the present capacity. These plans involve the purchase of the old Ivanhoe paper mill, which will be used as an erecting shop, and the ceding by the city of Pine street, from Oliver street to Market street, a distance of about 1,000 feet. New and improved machinery will be added. It is believed by some that the Erie Railway Company has a financial interest in the works.

Not only are the distinct locomotive building companies launching out into larger operations, but new railroad plants of magnitude are being erected. The Philadelphia & Reading has given out the last contract for the buildings of its new plant in Reading, Pa. The machine and erecting shop is about ready for occupancy. It is 200 by 740 feet. The plant will be provided with every convenience, not only in the shape of tools, but for the comfort of the mechanics. The boiler shop is 70 by 400 feet, with a lean-to of 50 by 400 feet. Some of the rolls have already been received for this department. The power house, which is almost finished, is 110 by 175 feet. It will be supplied with six engines; three are of the McIntosh, Seymour & Co. make, 600 horse-power each. The other three are a Harrisburg tandem compound of 300 horse-power and two simple engines of 75 horse-power each. The forge and smith shop that is now being built is 60 by 550 feet, with a lean-to. The foundry will be 130 by 400 feet, but this building may not be started much before spring. There will be a large three-story pattern and carpenter shop. There will also be a foundry stock house, store house, engine-cleaning pit house, office, etc. Ten cranes, all of which will be handled by electricity, except one, will be required in the different departments. Among these are two of 120 tons and two of 35 tons capacity in the erecting shop. The steam at the power house will be supplied by eight Wickes vertical water-tube boilers, 250 horse-power each. Roney mechanical stokers will be used. There will also be one duplex cross-compound Ingersoll-Sergeant two-stage air compressor for furnishing the power to operate the tools in the shop and for other purposes. It will require a number of electric motors to run the machinery in the shop proper, and many of the lathes will have separate motors.

In view of the activity of railroad work it goes without saying that the Railroad Supply Company is booking a lively demand for all sorts of its tools and track equipment. The present season of the year is especially favorable to the sale of such of these lines as are to be used in the manufacture of various staple sorts of material required for next spring's work. The railroad demand arising from new enterprises, we are informed, is particularly good in the West and South, while the Eastern roads continue steady buyers of supplies. Pneumatic tools, it is added, are selling in as good volume now as they did earlier in their history. Locally, there is a good demand for them for use in bridge and dock work, etc. Supplies for traction roads are in eager requisition.

A DISTINGUISHED FOREIGN SHIPBUILDER ON AMERICA'S DEVELOPMENT.

Sir Christopher Furness, of Furness, Withey & Co., Ltd., is about to return to England after a trip through this country. Sir Christopher is part proprietor of five British shipbuilding yards which last year turned out more shipping than all those in the United States. He says that shipbuilding has been overdone in England. America, he says, enjoys an advantage from the cheaper cost at which steel can be produced, but the great demand for it at present keeps the price higher than

that in England. In the long run, it seems reasonable that we can afford to sell it cheaper than the British producers. As to wages he thinks that there are as many men in his yards earning as high wages as those in this country. In fact, he is quoted as saying that if like wages are paid American shipyard labor is the cheaper because the American workmen put in 20 per cent. longer hours than the English. Sir Christopher is an outspoken disbeliever in subsidies. He comments upon the rapid growth of the shipbuilding industry in America in the last few years. At Richmond, Va., for instance, the Trigg shipyard, which commenced there some three years ago, is now crowded with work, including the construction not only of passenger boats but of torpedo boats and other government vessels. He visited all the large shipyards of the country and found that they had as much work on hand—more, in fact—as they could reasonably expect to deliver. He is impressed with the idea that the most promising field for development in the United States is the Pacific Coast. Sir Christopher admitted that he himself was interested in a project for the establishment of a large plant in the United States.

MISCELLANEOUS.

At the New York office of Hill, Clarke & Co., 253 Broadway, October was found to be the best month so far. There has been a good demand for friction drills and Bath cutter grinders. A recent sale of five of the drills was to the Eclipse Manufacturing Company, maker of the "Morrow" bicycle brakes, Elmira, N. Y.

A contract has recently been let for equipping the Alsens-American Portland Cement Works, West Camp, N. Y.—a 9-kiln plant—with elevating and conveying machinery, etc., to be built by the Webster Manufacturing Company, Chicago. Lathbury & Spackman, of Philadelphia, are the engineers. The Vulcan Iron Works, of Wilkesbarre, Pa., are builders of the engines, and the Crocker-Wheeler Company has made shipment of three 400-kilowatt and one 100-kilowatt dynamos.

A new plant for the manufacture of a line of sheet metal working machinery is to be built in Pittsburgh, Pa., by Charles McSherry. The "Hercules" shear will be one of the machines manufactured there.

The Census Bureau at Washington has given out the results of its investigations last year into the manufactures of Vermont. The manufactured products of the State increased from $38,340,066 in value in 1800 to $57,646,715 in 1900. The amount for 1850 was $8,570,920.

Some of the people who get up rumors about J. P. Morgan think they see signs that he is going to back the Bullock Electric Manufacturing Company in a formidable competition with the General Electric and Westinghouse companies. The idea emanates from Cincinnati in this instance.

The Crocker-Wheeler Company, of Ampere, N. J., are so thoroughly under the effects of the industrial boom that they have been working with a regular night force for some months past, and are constantly adding to their number of factory hands. Among the shipments that they have made during the last month are a number of big machines intended to go into copper refineries, steel works and other engineering establishments. We may note, for instance: Two 520-kilowatt generators for the American Smelting & Refining Company, Perth Amboy, N. J.; one 400-kilowatt generator for the Christenson Engineering Company, Milwaukee, Wis.; one 300-kilowatt generator for the Balbach Smelting & Refining Company, Newark, N. J.; one 200-kilowatt generator for the Crucible Steel Company, at Blair, Pa.; one 150-kilowatt generator for the Latrobe Steel Company; one 200-kilowatt for the Otis Elevator Company, and one 100-kilowatt generator for the United States Tube Company. The Company has also finished shipping a 45-kilowatt direct-connected generator and fifty or sixty motors for the Government Printing Office in Manila, Philippine Islands.

CHICAGO MACHINERY MARKET.

A machinery salesman recently returned from a business trip through Indiana steel works, foundries and machine shops says that manufacturers all have orders booked ahead, often for six months. They are quite commonly building additions to their works. The same condition of active building operations prevails generally throughout the West. All kinds of building plans, and to almost unprecedented extent, are in contemplation or in actual progress. Manufacturers have prospered and are putting their money back into increased plant capacity. The generality of this expansion is the one feature which surprises, not disagreeably, the machinists' supply trade. In a manner, some makers of shop fittings have lost their bearings. Formerly periods of activity had a beginning and an end, lasting perhaps three or four months and followed by a period when the work grew slack, when figuring became close and when economies of various kinds were practiced. Those business men who are disposed to look ahead and to anticipate probable conditions had looked for a falling off of business about this time. They would not have felt disappointed if the time of quiet had made its appearance, for that was the rule of previous trade. However, there is no decrease in business. Out of a dozen dealers in machinists' supplies and manufacturers of shop specialties interviewed, about half the number say that November this year is the best month they have ever had, not merely the best November but the best month. The remaining makers and dealers report uniformly that business is unsually good, keeping up well with October, or falling behind only slightly.

This activity is so widespread that it defies more than the barest generalization. There is no line of industry that is lagging. The trade is trying to reconcile its preconceived notions with the situation. The more daring are looking ahead and beginning to predict for 1902 a year of activity fully as great as that of 1901, if not greater. They are inclined to that view by the very large amount of business already in sight, by the confidence that is almost universal and by the readiness to spend money and engage in new enterprises; in short, by the vastly widened market that is opening. With this sentiment abroad, the pulse of trade could not well be otherwise than full and strong.

In a mercantile way machinists' tools are in fair supply. Some delay is experienced, which is attributed mainly to the scarcity of steel material, but on the whole there is little complaint on that score. Production is fairly well keeping the trade stocked with goods.

James & Foote are running their shop full time, and occasionally working overtime. Demand for gears and other products is large and steady.

Quotations.

NEW YORK, Monday, Dec. 2.

Pennsylvania Foundry Pig Irons, Jersey City delivery:

No. 1 X	$16 15 @ $17 50
No. 2 X	15 65 @ 16 15
No. 2 plain	15 15 @ 15 65
Gray forge	14 75 @ 15 00

Alabama Pig, New York delivery:

No. 1 foundry, or soft	15 75 @ 16 25
No. 2 foundry, or soft	15 25 @ 15 50
No. 3 foundry	14 75 @ 15 00
Foundry forge, or No. 4	14 25 @ 14 50

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.68c. in carload lots. From store, 1.90 @ 1.95c. in small lots.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—1.90 @ 2.00c. from store.

Cold Rolled Steel Shafting—Base sizes—From store, 2¼ @ 2½c.

Copper—The English market has broken sharply, but recovered more than one half. Rumors of very low prices are rife, but it is questionable if Lake ingot can be fairly quoted under 16¾ @ 17c. or possibly ½c. less; electrolytic, 16¼ @ 16⅝c.; casting copper, around 16c.

Pig Tin—In 5- and 10-ton lots f. o. b., New York, 26 @ 26½c. for spot.

Pig Lead—For wholesale lots, 4⅜c., with .02½ @ 05c. extra for carloads.

Spelter—4.32½ @ 4.37½c., New York delivery.

Antimony—Cookson's, 10¼ @ 10⅜c.; Hallett's, 8¼ @ 8⅜c.; United States, 8⅜ @ 8½c.; Italian, 7¾ @ 8c.

Lard Oil—Prime City, 77 @ 78c., in wholesale lots.

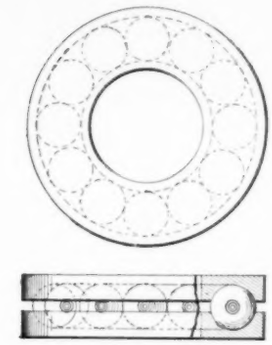


Fig. 1

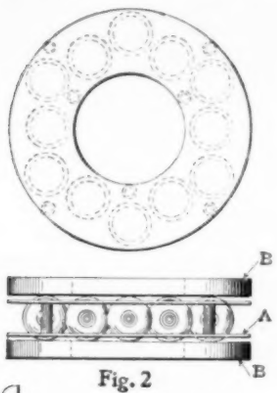
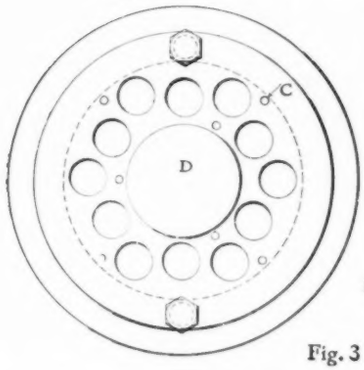


Fig. 2



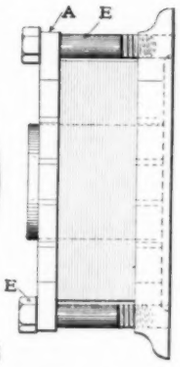


Fig. 3

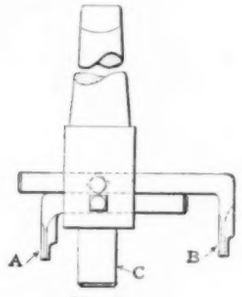


Fig. 4

American Machinist

A BALL THRUST COLLAR AND ITS MANUFACTURE.

A Ball Thrust Collar and Its Manufacture.

The article to be manufactured was a thrust collar for a freight elevator worm shaft.

The first form of these collars was to make them of two plates of steel, grooved out to accommodate the steel balls as shown in Fig. 1. The first half-dozen made proved quite satisfactory, and the shop manager ordered special tools made—*i. e.*, an end mill for grooving and a special facing tool. After these tools were finished and a few more collars made, it was found that a large number of them were unfit for use, due to warping during the hardening. We tried to use some of the better ones, but as soon as pressure was applied and the shaft turned, the collar would break.

This condition existed for about two years, each warped collar being scrapped during this time, and the firm putting out upwards of $400 in special tools for the different sizes.

At this juncture the manager conceived the idea of making a good collar as per Fig. 2, the part *A*, or cage, being made of hard brass and *B B* made of steel, afterwards hardened and ground true.

The first method used in making the cages was to "lay out" on a large sheet of brass a number of pieces and, using a ¼-inch drill, drill the center hole with it first, after cutting the blanks out roughly with bench shears. Then using the small hole as a guide and placing the rough blanks one on top of the other and making them fast to an old plate, the proper size hole was drilled. Our next move was to make arbors, with thread and nut, to hold the blanks while turning the outside diameter; also a jig to drill holes *C C*, Fig. 3. The plate *A* is of steel and hardened. The stud *D* is a sliding fit for the bore of the cage, and the cap-screws *E E* are to fasten down the work.

This last method was considered good until the writer offered the tool shown in Fig. 4, the use of which did away with three operations, namely, drilling the large hole, putting on the arbor and turning.

To use this tool it is necessary only to drill a hole for the guide *C* and use a clamp to fasten down the brass. It might be well to state that the cutter *A* was made about 1-32 inch longer than cutter *B*, to insure the cutting out of the center before the outside cutter came through.

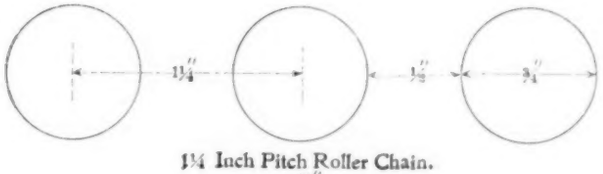
J. N. GERMAIN.

A Proposed Standard Roller Chain.

Most machinists of wide experience appreciate the value of standards. It is of course well recognized that everything cannot be standardized, but certain parts of machines can be reduced to standards so as to be interchangeable, and the adoption of such standards is not only a great convenience, but also results in very great economy of manufacture and repair. When a standard has been generally adopted, those who happen to be committed to some construction or part not standard usually find it very inconvenient and expensive; yet it is in many cases impossible to then change to conform to the generally adopted standard. As might be expected, therefore, the Whitney Manufacturing Company, of Hartford, Conn., has appreciated the importance of the

¾ Inch Pitch Roller Chain.
Rivets 7/32" diam.

1 Inch Pitch Roller Chain.
Rivets 9/32" diam.



1¼ Inch Pitch Roller Chain.
Rivets 11/32" diam.

American Machinist

1½ Inch Pitch Roller Chain.
Rivets 13/32" diam.

adoption of a standard roller chain for automobiles; and as it is probable that a standard chain for this purpose will soon be adopted, the company named above submits a chain which is systematically designed and proportioned in different sizes and pitches, and which it is believed is the best compromise among all the various considerations attending the manufacture and use of such a chain. The rivets must of course be large enough to give the maximum of strength in the chain, while the rollers must not be too large, else they reduce the thickness of the sprocket-wheel teeth too much. As a result of very considerable study of the problems involved the Whitney Manufacturing Company have adopted chains of the dimensions shown in the accompanying diagram, and which it is hoped will be adopted as the standard of this country. The ¾-inch pitch chain has the same size roller that is used in chains of other makes, and it will therefore interchange on other sprockets, but it is found that some chain makers are using practically the same size rivet for chains varying from ¾-inch pitch to 1¼-inch pitch, which of course cannot be right.

A Large Ball and Socket Bearing and the Tool for Making It.

In the article showing some of the new facilities of the Westinghouse Machine Company for doing large work, which was published in our issue No. 40, mention was made of the use of a self-adjusting ball and socket construction in the main bearings of large vertical Corliss engines and a half-tone illustration of a special boring fixture at work boring the spherical seat was given.

These bearings are of such unusual magnitude for the ball and socket construction that great interest attaches to them. By the courtesy of the Westinghouse Machine Company we are able to present herewith some detail views of the bearings, as well as additional half-tones of the spherical boring fixture. With these we reproduce the half-tone which was published in the previous article, as it assists in showing the method of using the fixture.

Fig. 1 gives four views of the lower half of the bearing proper, from which the size of the work will be apparent. The shaft will be seen to be 34 inches in diameter, while the bearing is 60 inches long and the diameter of the spherical seat is 4 feet 11 inches.

In many of these large electric power house engines the combined weight of the shaft, armature and flywheel is sufficient to overbalance the entire steam pressure on the piston. We are not informed whether this is the case with the engine to which this bearing belongs or not, but in any event it is obvious that the upper half of the bearing has but a small amount of work to do compared with the lower half. The value of the self-adjusting feature is, in consequence, confined chiefly to the lower half, and entirely so if the parts are heavy enough to resist the steam pressure. The upper half of the bearing is therefore quite properly but one-half the length of the lower one and the self-adjusting feature is confined to the lower half. Fig. 2 shows the upper part of the bearing, of which one half, marked *A*, is the cap proper, while the other half, marked *B*, is a shield whose only office is to cover up the bearing. These halves are bolted together, as shown, and each piece has holding-down bolts by which it is bolted to the bed plate, bottoming thereon by the surfaces *a a*. The joint surfaces *b b* do not reach the center line and thus leave the lower shell free to adjust itself. Fig. 3 shows the method of securing the babbitt in place. Fig. 4 shows the spherical boring fixture in place on a bed plate boring a seat for the shell, and Figs. 5 and 6 show the fixture turned up on its side, in which position the construction is more clearly shown. The square frame, by which the fixture is bolted to the engine bed plate, carries a heavy boring bar on which are

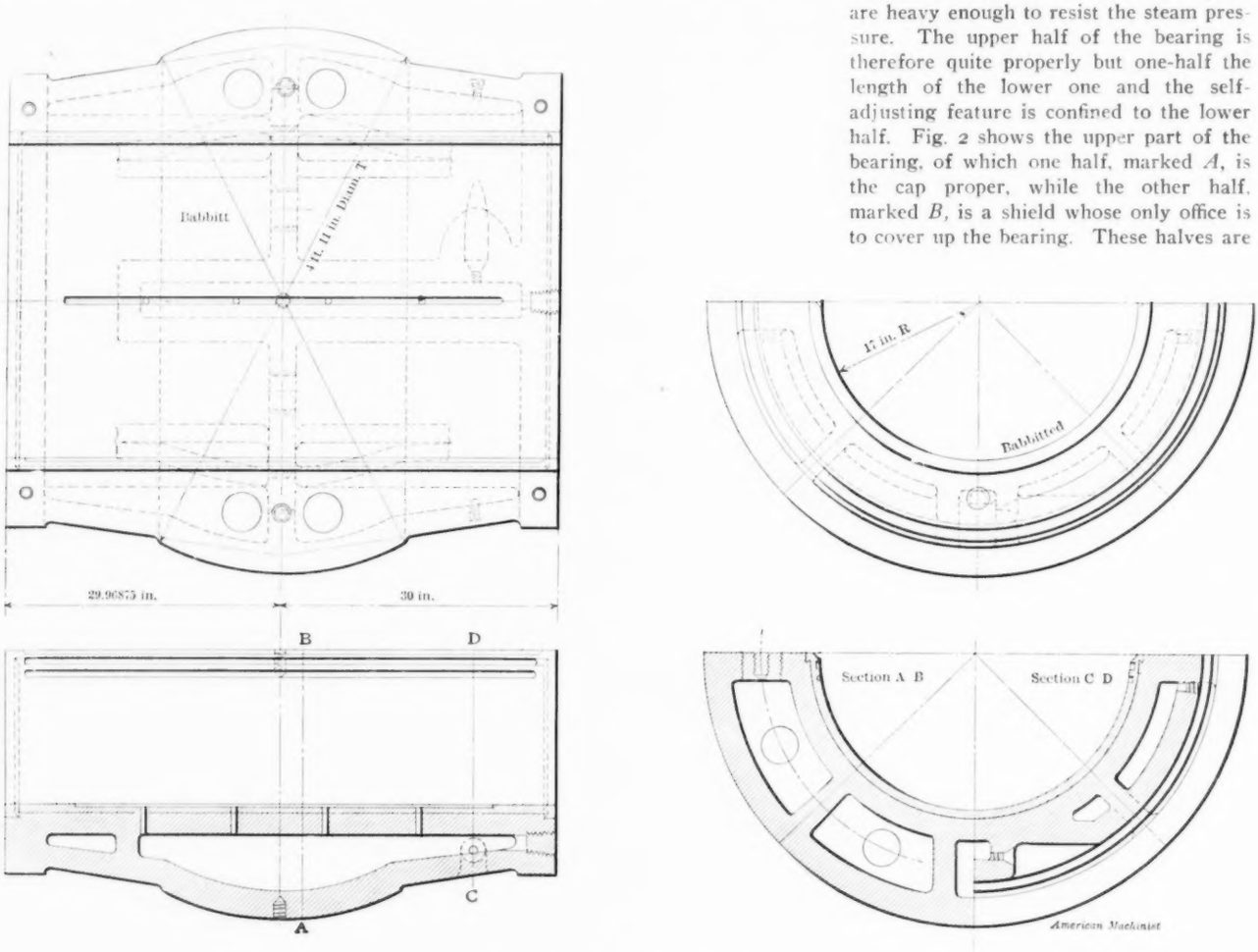


FIG. 1. LOWER HALF OF BEARING.

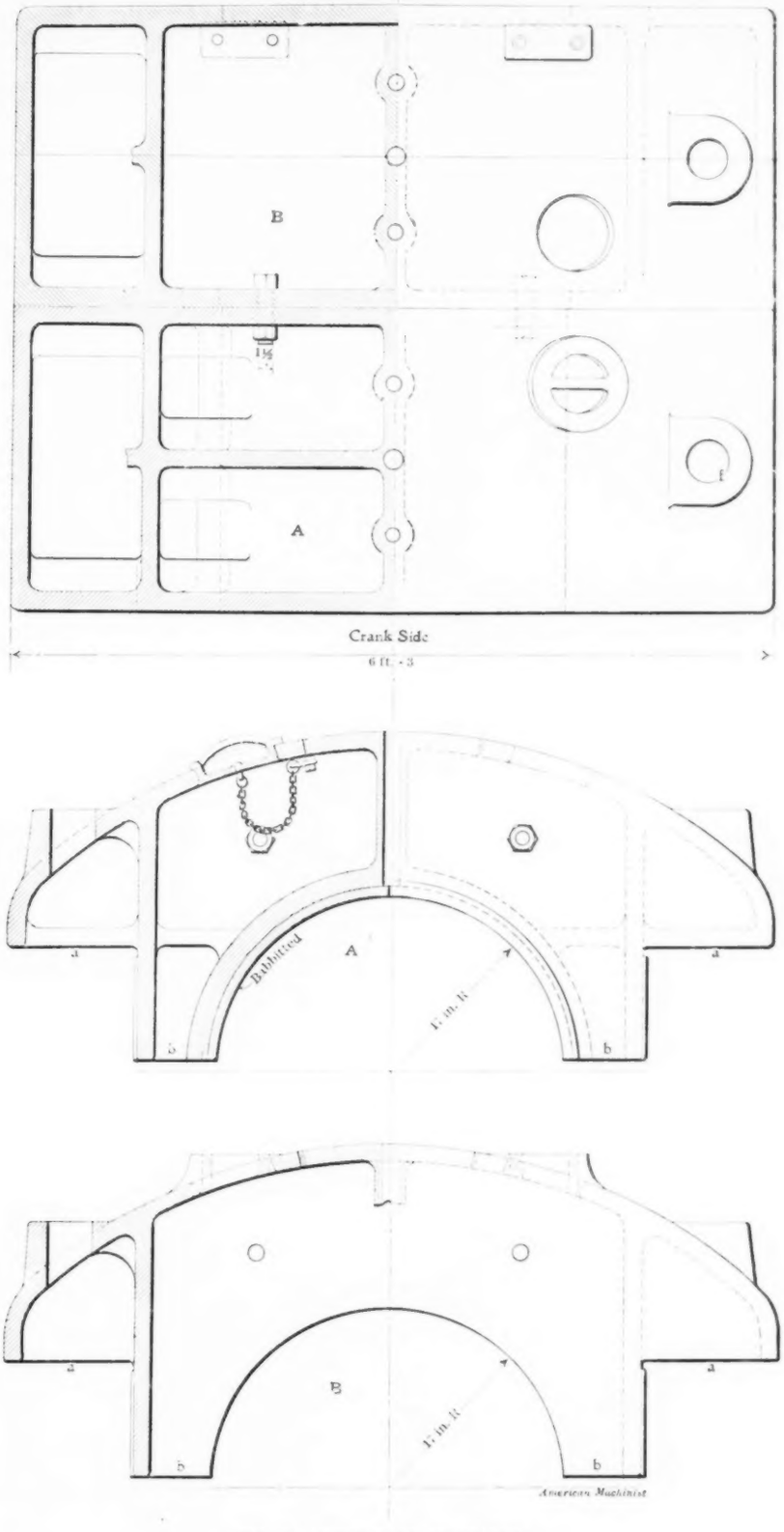


FIG. 2. UPPER HALF OF BEARING.

mounted two plain boring heads which slide on the bar and act to bore the short straight parts at the ends of the seat in the bed plate. A swivel boring head is mounted on the bar between the plain heads and by a link connection, which is plainly shown, the feed motion of the plain heads is made to swing the swivel head. This feed motion is obtained through a screw, gears and spindles projecting eccentrically from the shaft and squared for a star feed wheel. A squared spindle being fitted to each end of the bar, the feeding may obviously be done from either end at convenience. The drive of the bar is through a worm and worm wheel with a belt to an overhead shaft in Fig. 4, though work of this character is usually done at the Westinghouse works by a portable electric motor located on the floor.

Thoroughness in Invention.

As straws show the direction of the prevailing wind, so do the details of special machines of American make indicate why this country leads in the matter of production. The recent design of a foreign machine for cutting paving blocks shows a complication of design that is not to be found on an American machine. One item alone will illustrate the point. The machine has a reciprocating table upon which the deal is placed in lengths to be cut off to the required length of the blocks. These blocks lie between the saws until pushed out by the incoming deal. This is a feature that is entirely at variance with the

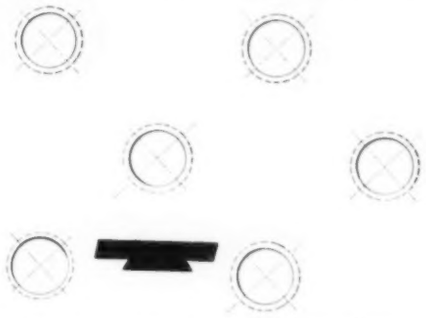


FIG. 3. METHOD OF SECURING BABBITT.

machine practice of this country. An American machine for work of this kind would probably have a chain feed in a table that would carry the blocks clear of the saws as soon as cut, thereby preventing any delay of the work from a possible accident by the blocks catching on the backs of the saws. The capacity is stated as about 100 per minute, but from the methods obtaining in other lines it is fair to assume that 50 will come nearer to the number that will be produced. On a chain-feed machine the product would be entirely dependent upon the agility of the operator, as the machine would cut 500 as easily as it would cut 100 if the stock could be kept on the feed table.—"The Wood Worker."

Shop Color-Blindness.

When a man visits the foundry for the first time, he sees things that to him are wonderful and fraught with intense interest. He speaks of the molds, of the flasks, ladles, cupolas, etc., and of the molten iron, and all the processes that he views, in a language foreign to the molder. But to call him "green" therefor is an evidence of color-blindness. The man may be a lawyer, a preacher, a farmer, a merchant, a prize fighter or anything else; so long as iron founding is new to him, it is a wonder to him. And while to us, who are over-familiar with every aspect of the business, everything about the foundry is

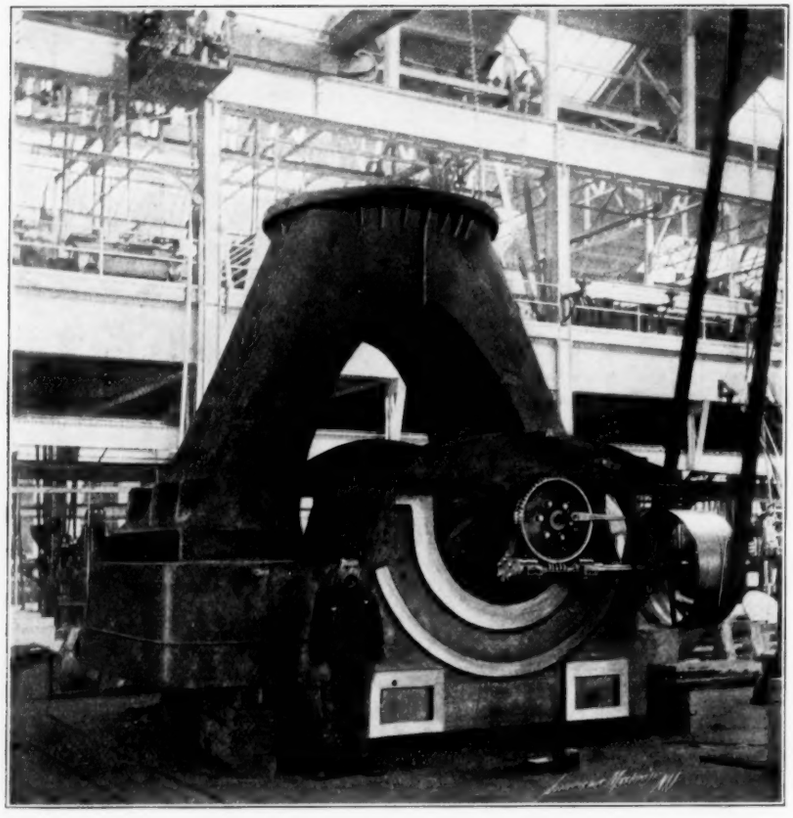


FIG. 4. SPHERICAL BORING FIXTURE AT WORK.

"an old story," I, for one, must confess that the hearty display of interest on the part of all classes of visitors to the foundry, and their ingenuous comments upon what they have seen, though couched in terms that sometimes prompt a smile, are among the pleasantest and most welcome of my experiences.

May it not be that we grow so used to looking only upon the utility side of the operations in our trade that we really need the occasional visit of an outsider to remind us of the existence of forgotten artistic aspects of the business, a due appreciation of which would add zest to our work?—"The Tradesman."

Poleforcia.

The energizing momentum engine which by means of rotary foot-pound work makes the new power, poleforcia, the spirit of the living thing in the wheels, whereas you can drag a weight along the horizontal with less power than you can lift the same weight; this is the traction law rotary—the new power, poleforcia.

This same poleforcia was first brought to my notice about eighteen months ago in the shape of a pamphlet entitled "Poleforcia No. 1." After struggling through its confused verbiage, much of the above style, I found a distinct and definite claim that by means of a curious and strange agglomeration of engines, flywheels, automatic clutches and shafts the poleforcia engine had been made to give an output greater than the input.

Here indeed was a fine idea. Some little time ago a Frenchman wrote a book on the coal resources of the British Empire and very plainly hinted that, in his opinion, this unlimited liability concern we call our home was all a matter of coal, and when—praise heaven!—the last cob of coal had gone up the last kitchen chimney, bust would go the British Empire and all about it that was so "brutal," with sundry other polite epithets, for which from a certain class of Frenchmen we now look as we do for our morning paper, or for more truths from Leyds. Here, then, was a fine scheme. To postpone the inevitable one simply took a 12 horse-power engine and attached it to a poleforcia machine and drew off 22 horse-power at the other end. It was all clear as mud. Having got the 22 horse-power we could put it through the mill or turn it into another poleforcia machine, and draw off probably 52 horse-power.

For a time I was happy, and thought of Keeley and electric sugar and the once promising Marchant engine—all fine contrivances for extracting the proverbial quart of ale out of a pint pot. I thereupon took up my pen and wrote an article on Poleforcia, and expressed my opinion upon it in what I considered was a very mild-mannered criticism indeed. I even added advice. I cannot recollect the words of that advice, though I have read them only to-day at the Law Courts. I know my advice ended with the word scrap-heap. This short criticism I sent to the "Electrical Review," of London, the journal that exposed the Harness Electropathic Belt business, and the article was printed, and very soon after someone else wrote to the "Electrical Review," namely, the lawyers of a Mr. Pole, asking for an apology on pain of an action for libel. It was thus that we first learned that Poleforcia was named after this Mr. Pole. The libel action was begun. By order of the Court the Poleforcia energizing momentum engine was ordered to be placed at the disposal of the defendants to test, and it was tested at that home of light and virtue, the

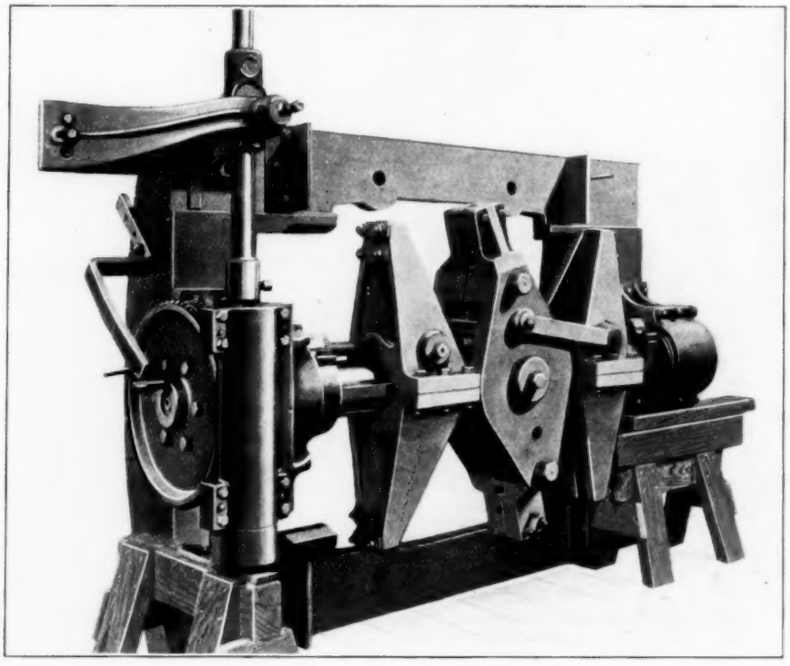


FIG. 5. SPHERICAL BORING FIXTURE.

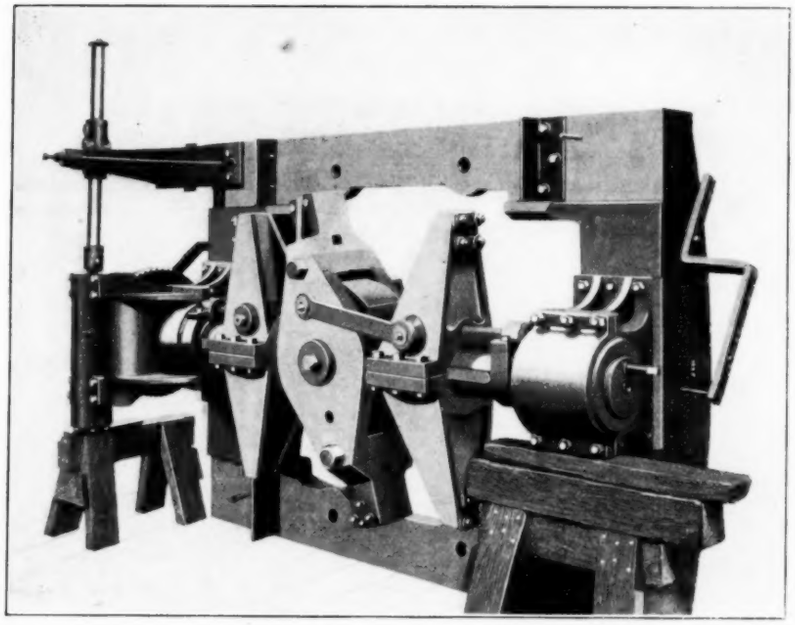


FIG. 6. SPHERICAL BORING FIXTURE.

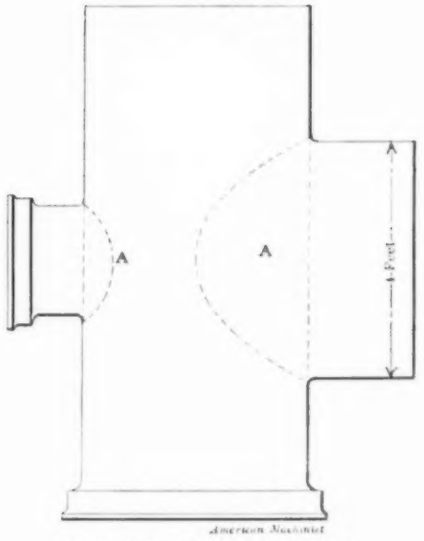


FIG. 1. THE CASTING TO BE MADE.

Aquarium, Westminster, with the result that by putting in about 1.6 horse-power about 0.56 was got out.

This was the very opposite of what was claimed. We should have put in 1.6 horse-power and got out about 4.8 horse-power. A still larger engine was tested at the Alexandra Palace, with similar disappointing results; but, all the same, Mr. Pole persisted with his libel suit, and after the many law's delays it actually came off to-day at King's Bench Court No. 2, before Mr. Justice Ridley and a special jury.

Mr. Pole had no less a counsel than Sir Edward Clarke, who made the best of his client's case. It appeared that Mr. Pole was of opinion that my article exceeded the bounds of fair criticism, and the scrap-heap reference was not relished. I note that the inventors of perpetual-motion machines never do think an engineer's criticism to be fair. Mr. Pole was asked if he had not been laughed at in America. He replied they always did laugh at inventors. He also exhibited a most remarkable ability in replying to questions by long sentences of long words, of the kind to which we are accustomed in his pamphlets, and put together in a way that conveyed no meaning to us. It was marvellous, and one thought again of Keeley's ability in the same line of words. I wrote in my criticism that the public would presumably be asked to subscribe money, or we would not have noticed the affair at all. This was claimed to be actionable. The jury, however, were of opinion that we did right in protecting the public against perpetual motion, for they gave a verdict for the defendants, and Poleforcia is hardly likely after this to energize the British public to the subscription point, though Mr. Pole told the court he had successfully formed a company in America, of which the stock stood high.

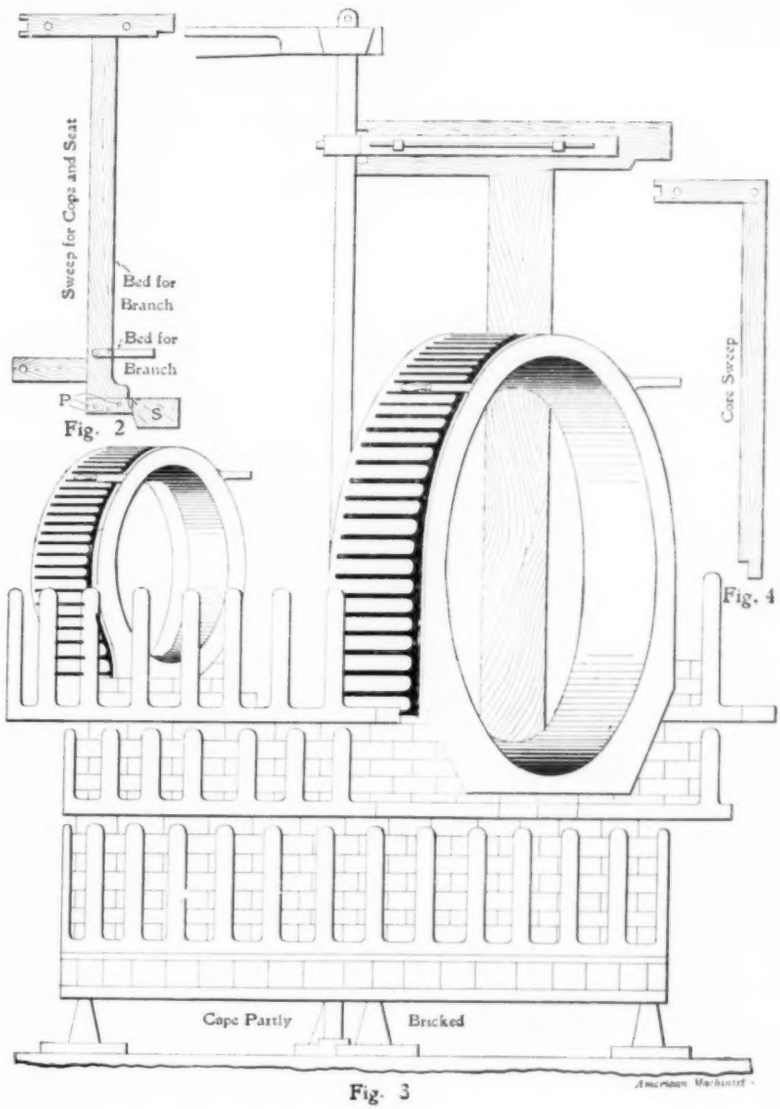


Fig. 3

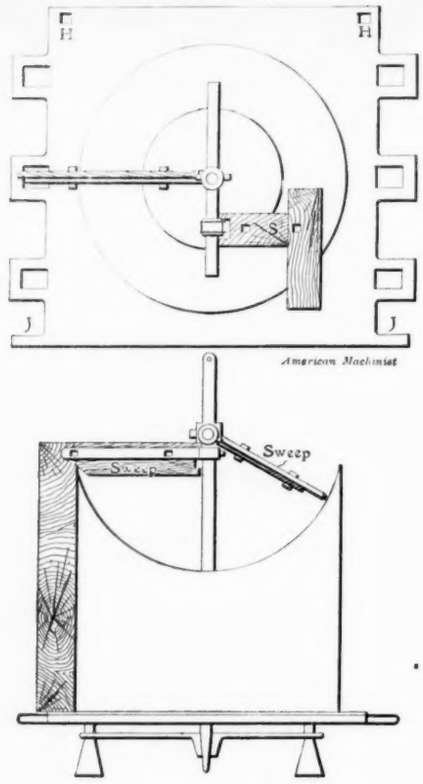


FIG. 5. BRANCH CORE AND PLATE.

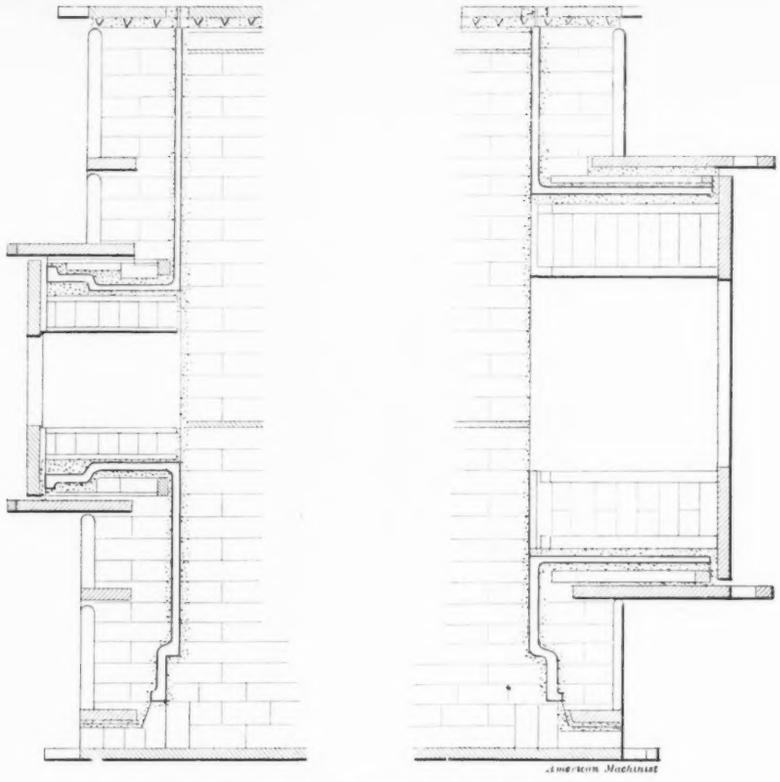


FIG. 6. VERTICAL SECTION OF PARTS OF MOLD.

Since this libel action began I have read in the "American Machinist" and in other papers comments upon Poleforcia very much more rude than anything I wrote in the "Electrical Review"; so much so, that I saw plainly the opinion held in America of this new power, Poleforcia.

All of us who are engineers run against perpetual motion from time to time. It assumes various forms, and changes color like the chameleon. There was the Marchant engine, that professed, I believe, some sort of reversed cycle, and when investigated turned out to have its prony brake supported by a block so placed as to bear the weight that should have come on the hand. The block was hidden by an accumulation of water on the floor. There was the Guattari motive power syndicate, which was difficult to unearth because for a long time no exact claim was made for actual perpetual motion, but finally an evaporation of 16 pounds of water was claimed per pound of coal, and this finished matters, especially when sworn to. Keeley did not honor this effete old country with his genius, but left it over as a remnant for Mr. Pole, whose numerous pamphlets have been so much in evidence to-day. But is it fair that respectable engineering journals should be sued for libel on account of running down a perpetual-motion machine? W. H. Booth.

London.

[We illustrated and commented upon the Poleforcia perpetual motion machine and patent at page 849, last year. It is a mechanical absurdity.—Ed.]

Molding a Large Cross Pipe.

Fig. 1 shows a 4-foot cross pipe 10 feet long, thickness of metal 1¼ inches. This pipe is made in loam and is worked up entirely with sweeps. Three castings nearly alike are wanted, the first one as here shown, the second without the small branch and the third with the socket cast on the large branch. These pipes are made without the usual "ramming up"; they are built up in a cage of prodded rings. The rings are made in open sand and the prods are driven into the bed with a sledge about 5 inches apart. When the prods are long—say, 18 inches—the bed is first dug up and the sand is riddled and well trodden into the trenches in which the prods are afterwards to be driven.

It will be noted that the weight of the tackle required when working with prodded rings is considerably more than when the mold is rammed up in the ordinary manner; it is, however, conceded by foundrymen qualified to judge that where several castings are required for which the same tackle is used a distinct saving is effected. Many foundries making large quantities of castings in loam keep entirely to this method, and some of the advantages claimed are: First, that the mold can be

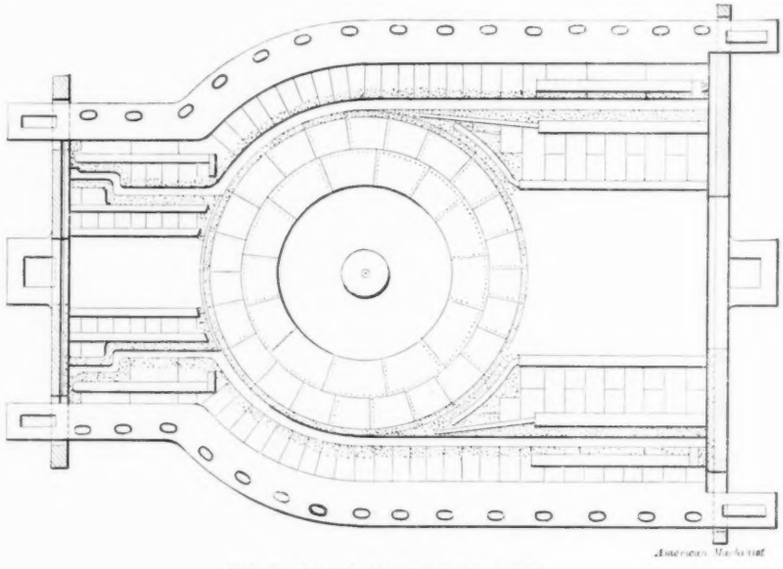


FIG. 7. SECTIONAL PLAN OF MOLD.

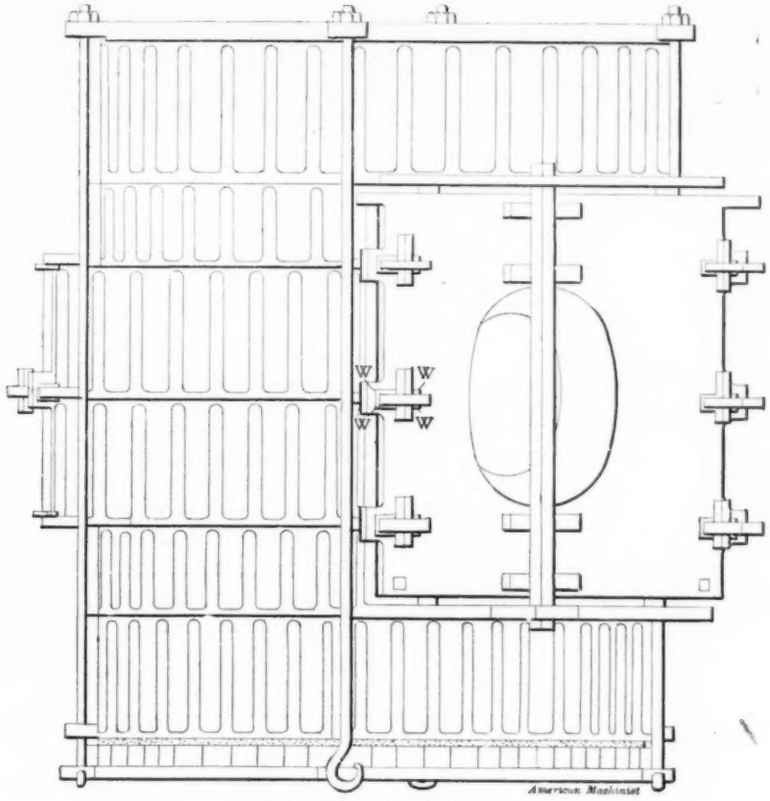


FIG. 8. THE MOLD COMPLETE.

poured within two or three hours after the top plate is dropped on, leaving no time for the mold to get damp, which is perhaps one of the worst evils which the loam molder has to contend with. Another advantage is that the mold may be poured if necessary from the floor level, and not sunk into a pit, which is of course indispensable with the "ramming up" method. Again, straining of the mold caused by careless ramming is unknown where prodded rings are used, and the free egress of the gases from the mold and cores when pouring are favorable conditions in the production of sound loam castings.

A bottom plate having been secured on which the mold is to be built, it is set level and the sweep for the cope and seat, Fig. 2, is fastened on to the spindle and the seat is bricked up and the loam swept on. When the loam is set fairly hard, the seat is finished off and the portion *S* of sweep is removed by taking out the screws. When the bearing is set hard enough a joint is made by placing paper against the inclined part of the seat, and parting sand on the bottom face of the joint. A coat of loam is next placed on the joint, and the cope ring is bedded well down on to it. The cope is now bricked up as high as the first finger on the cope sweep; a bed is swept in the cope and the finger is removed and a fire is placed on the bed to harden it so that it will bear the weight of the branch mold. Previous to this rings with flat pegs cast in at a sufficient distance apart for a brick to be jammed between each, had been swept up and dried in the stove. One of these rings is next turned up on its side and set on to the bearing on the cope, a flat place having been provided on the branch mold or ring and trued up square. This flat part sits on the swept bearing on the cope, and facilitates the setting of the branch in the desired position.

Fig. 3 is a view of the cope partly bricked, showing the two branches set. As the bricking up proceeds, a short straightedge is worked inside each branch to correctly form that portion of the mold which is not formed by the cope board nor yet by the branches. This part, seen at *A*, Fig. 1, is where the branch dies away into the body of the pipe. When the cope is finished it is lifted off its seat and the body core is built up, the sweep, Fig. 4, being used for that purpose.

The cores to form the branches are swept on plates having prods cast on, or on a grid with suitable pegs bolted to the plate. Fig. 5 is a plan and side view of a core and plate, showing the sweeps set and the method of forming that part of the branch core which fits against the body core. The sweep *S* and the arm which holds it to the spindle are changed from side to side as required.

All parts of the mold having been blackened and dried, the branch plates and cores are turned up on the side by the "snugs" *J J* and bars wedged into the square holes *H H*. Suitable weights are placed on these bars to balance the weight of the core. The core with plate is now hoisted up to the hight of the branch opening, and slid into its place in the cope. A molder stationed inside the cope instructs the men outside to move the plate in either direction as desired for obtaining an even thickness. When this has been obtained the plate is wedged in its place with iron or steel wedges. The smaller branch is set in a similar manner, but after it is set its position is marked and then it is drawn back about an inch, and it is fastened there. This leaves ample room for clearance when lowering the cope over the body core. Before dropping the cope over the body core, and when both branches are set in their exact positions, a templet is tried inside the cope over the branch cores to note that they do not extend too far into the cope and cause a crush when closing, or that they are so far back as to leave too much fin. This done the cope is carefully lowered on to its seat and the thickness at the top of the cope is noted. If the thickness is not uniform the cope is either wedged off the bottom plate or it is hoisted a little and a sheet or two of paper is placed on the joint to throw the cope over at the top. The branch which was placed an inch back is now pinched carefully forward to its place and wedged securely. Fig. 6 gives a side view and Fig. 7 a sectional plan of the mold complete.

The top plate is now dropped on the cope, the gates are tried to see that they come in the center of the thickness, and the mold is bound with four bolts. Fig. 8 shows the mold complete and the method of fastening the branch plates. Wedges *W* are driven into all spaces around the various snugs, and the square bars dropped into the snugs under and over the branches help to bind the plates and rings securely together.

These pipes require very little dressing, as there are no joints in the cope, and these and other similar castings have been successfully made entirely with sweeps. There is, however, considerably more skill required on the part of the molder in making these castings by this method than by some others in which more pattern making is necessary; and it is only here and there in the foundry that a man is found capable of carrying jobs of this kind to a successful issue.

Some Special Turret Head Tools.

BY JOSEPH V. WOODWORTH.

The tools shown in Figs. 1, 2 and 3 are for making small tubes used for perforating leather shoe tips. These tubes run from 1-16 to ¼ inch in diameter, are made from drill rod and are required to be finished with a smooth reamed hole through them, true with the outside, and with one end chamfered to a sharp edge. In producing the larger sizes of tubes, very little trouble was encountered; but for the smaller sizes (and they were required in the largest quantities) much trouble was met with, and the best results were accomplished by the tools here shown.

Fig. 1 is for chamfering the ends and

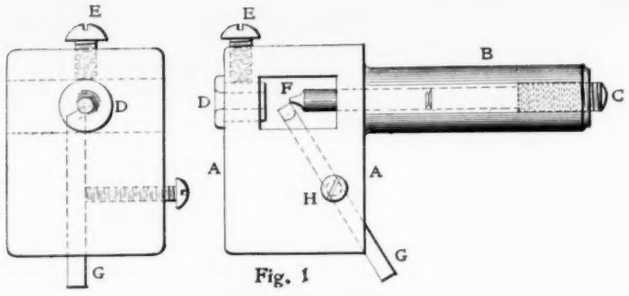


Fig. 1

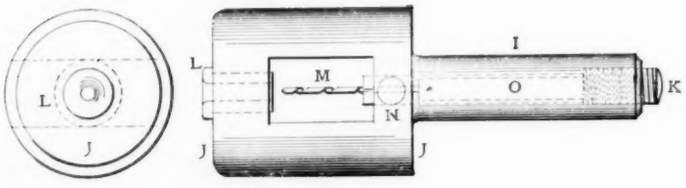


Fig. 2

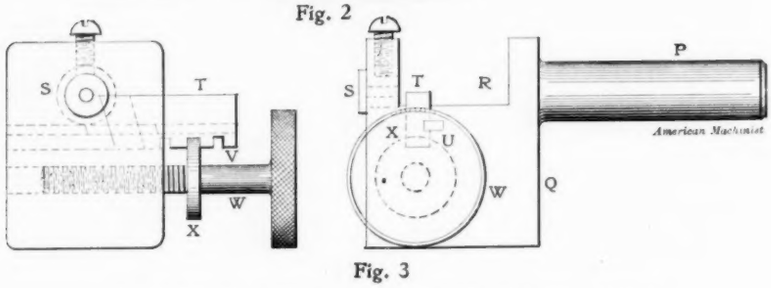


Fig. 3

TURRET TOOLS FOR MAKING SMALL HOLLOW ROUND CUTTERS.

centering the tubes. The body or box portion, of cast iron, has a hole through it for the centering tool *F* and its adjusting screw *C*. A hole is broached through the body for the chamfering tool *G*, at an angle which allows the face of *G* to be ground square. The bushing *D* is of tool steel, is hardened and lapped to the size of the drill rod. By chamfering the end of the tubes with this tool, before drilling and reaming the hole, a sharp edge can be produced.

Fig. 2 shows the tool for drilling the tubes. The drill is held in a split bushing by the adjusting screw *K* and round-head screw *N*. The bushing *L* is forced into the holder.

Fig. 3 is for cutting off the tubes. On account of their small diameter it is necessary to support the stock under the operation. The body of the tool is of cast iron. The cutting-off tool is of a somewhat special construction. It is of ¼x½-inch stock, finished all over to fit within the channel, and with a groove in one side for the feather *U*. The grooves *V* on the bottom are for the collar of the feed screw W. The cutting end of the tool *T* is finished to the usual shape required for such a tool, as narrow as possible, according to the size of the stock. These three tools produce the perforating tubes to the degree of interchangeability and accuracy required, and in a very rapid manner. The tubes, after being thus finished, are hardened and tempered to a dark blue, and are forced into radial holes in a mild steel disk. Different combinations of sizes of tubes are located in these disks, to produce the pattern desired in the leather shoe tips and miscellaneous leather findings

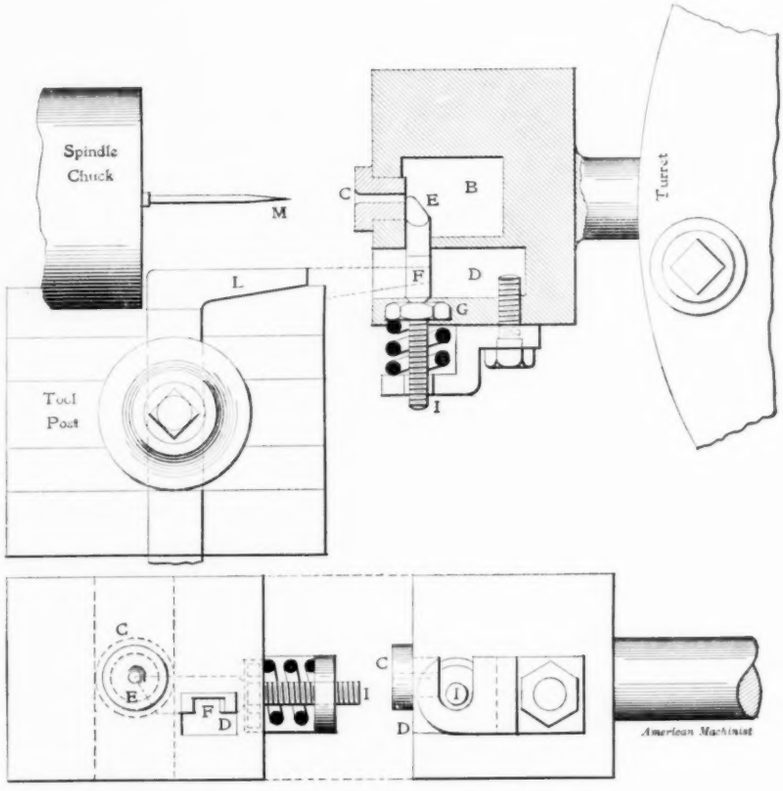


FIG. 4. BOX TOOL FOR POINTING NEEDLES.

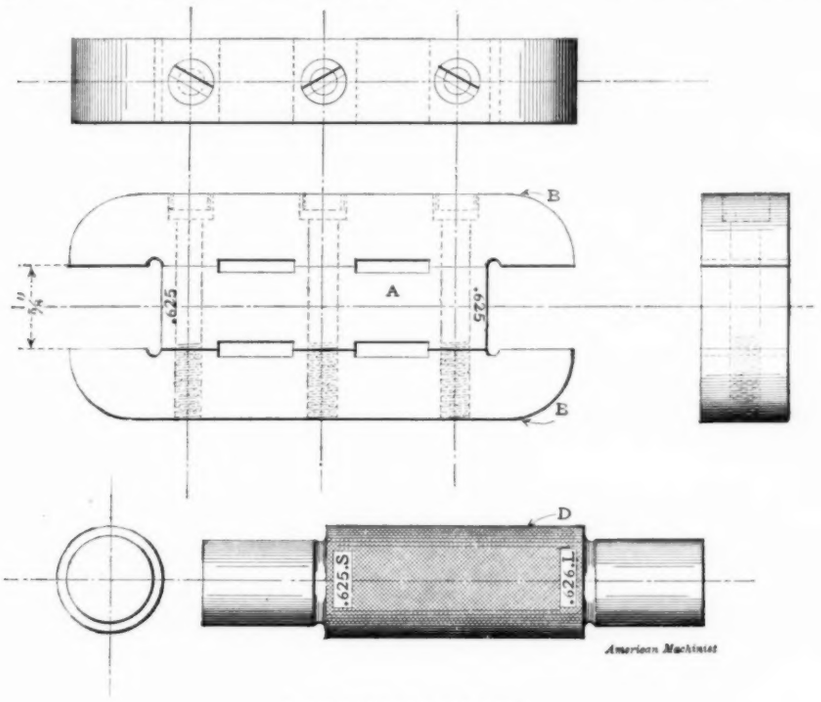
The box tool, Fig. 4, of a distinctly different type from those above described, is used for pointing slender needle valves on an incandescent oil lamp of well-known make. It is rather difficult to point wire of small diameter by the ordinary means available in the turret machine, especially if the points are to taper quite gradually, as at *M*. By the ordinary method the cutting surface of the tool would be so wide that it would be almost impossible to keep the wire true and hold it sufficiently rigid. The body or box portion of the tool is a forging of mild steel, with a rectangular hole at *B* and a tool-steel bushing at *C*. The cutting tool *E* is fitted snugly into a square broached hole, the side of which is in line with the end of the bushing. The rear end of the tool is threaded for the adjusting nut *G*. A bracket is fastened to the body of the tool, and the spiral spring, which is required to be quite stiff, is located as shown. A hole is let into the body at *D*, as clearance for the angular-faced tool-post fixture *L*. *A* channel *F* is let into the under side of the pointing tool *E*, with a taper side at the rear coinciding with the taper of *L*. In beginning operations, the cutting tool *E* is allowed to project, adjusting by the nut *G*, slightly beyond the center of the bushing *C*. As the box tool is brought up to the work, the wire enters the bushing *C* and the tool-engager enters the hole *D*. As the tool *E* begins to cut, the engager *L* commences to force the tool back, and continues to do so until it ceases to cut and the wire is pointed as shown. The turret is then brought back, and the spring causes the cutting tool to resume its former position.

A Permanent Snap Gage.

BY C. W. PUTNAM.

The snap gage article in issue No. 45, page 1251, leads me to send an idea of a snap gage that I think is O. K. It consists of jaws *B B* and center piece *A*, the latter being the exact width of dimension desired. After pieces *B B* have been ground and lapped, they are put together by means of screws, as shown. Plug *D* is a good gage to test the snap gage with.

In constant use a snap gage of this kind will wear, especially if used to test round pieces such as would naturally be turned and twisted in the gage, and give rise to hills and valleys. This may be detected by a plug gage, as shown, one end of which is of the same size as the snap gage and the other end .001 or .0005, or any limit that may be established larger. When the big end of the plug will enter the snap gage



A PERMANENT SNAP GAGE.

it should be taken apart, ground if necessary, lapped and put together, when we have again a new gage with little or no expense. One end of plug is marked size by *S*, the other end limit by *L*.

[This is no doubt a very superior form of gage. Its great merit lies in the fact that the more expensive piece *A*, which determines the size, is not subject to wear, while the correction of the gage when worn does not involve any expensive work, but merely the resurfacing of pieces *B*. The screws should be a loose fit in *A*, to avoid any tendency to swell that piece. Most of these gages that we have seen (and they are the accepted form of gage in some leading and first-class works) have but a single end, two screws only being used and one end of *A* being extended beyond the jaws to form a handle, thus making a gage which is more like the usual form. The construction shown has the advantage that at a trifling additional expense two gages are made. It would, however, be obviously impracticable to make these of different dimensions to act as limit gages.—Ed.]

The Summer School of the University of Wisconsin.

At page 580 we published a description of the plans of Professor J. B. Johnson of the University of Wisconsin for a summer school on industrial lines and intended especially to meet the wants of mechanics and apprentices.

We have been favored with a copy of the report to the president of the University on the work done during the session, from which it appears that the results were eminently satisfactory. Ten of the regular teaching staff of the University were engaged in the work and the total number of students enrolled was 45, of which 28 may be considered as typical students of the classes for whom the school was projected, the remaining 17 being principally regular students of the College of Engineering who took advantage of the opportunity to make up shop work. Of the typical students there were representatives of such occupations as central electric station employee, gas works employee, shop foreman, lineman, stationary engineer, machinist and machine shop apprentice.

The original plans of the school contemplated co-operation with the correspondence schools by giving their students shop and laboratory work which those schools are unable to do. This feature proved to be a conspicuous success, several students of the correspondence schools having attended, some of whom have taken occasion to express their gratification at the manner in which their studies were supplemented by the shop and laboratory practice.

There seems to be no doubt that the school will be continued in future. Present plans contemplate dividing the work into an elementary and an advanced grade, the latter being intended to meet the wants of those who attended during the past session, several of whom have expressed a desire to attend again.

The school is also said to have attracted wide attention from other engineering colleges and it is probable that a number of them will at once inaugurate similar summer schools.

We need not add that we are highly gratified at the showing made. It is enough to make one's heart ache to contemplate the great plants of our numerous colleges and universities lying idle during the summer season. Professor Johnson seems to have found a most praiseworthy method of utilizing them and one which has achieved the success it deserved.

Spiral Gears Set at 90 Degrees.

BY JOHN RANDOL.

Undoubtedly all gears up to, say, 4-inch face by 3-inch diametral pitch should be cut with spiral teeth, and an angle of 5 degrees is quite enough to help greatly towards smooth and still running, but this article deals more particularly with gears which are mounted on shafts standing at right angles to each other and not in the same plane. Such gears may be used to take the place of bevel gears, and are in every way vastly preferable thereto, because they are silent in action and may transmit motion in either direction, and may be of any diameter and at the same time have any relative shaft speeds, and because bevel gears must be accurately placed in relation to each other to give even a fairly good life and action, while spiral gears will run still for a long time under heavy loads, no matter whether the shafts are correctly placed or merely set pretty nearly right.

Many persons are of opinion that spiral gearing on 90-degree shafts wastes a great deal of power in friction, and that it is therefore much less efficient and durable than bevel gearing doing the same work. This view is wholly incorrect. The faces of all gear teeth, spur, bevel and spiral, rub hard against each other when doing hard work; the spiral toothed gear has the vast advantage of a much higher speed of the rubbing surfaces and so will transmit the same load with much less crushing effect on the gear tooth faces, and hence runs the easier of the two and is the more durable, if both forms are well lubricated and perfectly enclosed against dust, as gears now not infrequently are and always should be. It is an easier matter generally to enclose spiral gears on 90-degree shafts than to case in bevel gears on shafts in the same plane. The bevel gears usually require spe-

cial dust covers, while in the case of gears set at an angle on shafts not in the same plane they may almost always be provided with an oil cellar and be enclosed, except one half of one gear, without any extra piece at all, while the covering for the remaining exposed half gear takes the easy form of a semi-cylindrical cup held in place with two small screws. The bevel gear casing commonly has much the more complicated shape.

While almost all machine designers of both high and low degree are aware of the existence of this spiral toothed substitute for bevel gears, and many of them are fully alive to its virtues, the spiral gear is seldom used, although the relative merits of the two systems should cause the spiral gear to be the regular and established form, and the bevel gear, noisy and difficult to place, should be the rare exception in geared power-transmission practice.

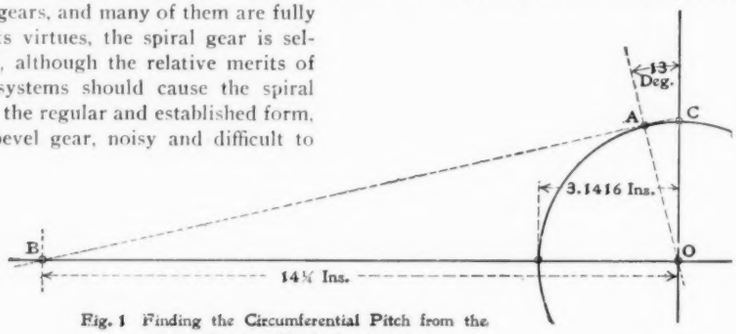


Fig. 1 Finding the Circumferential Pitch from the Cutter Pitch. Tooth Angle given.

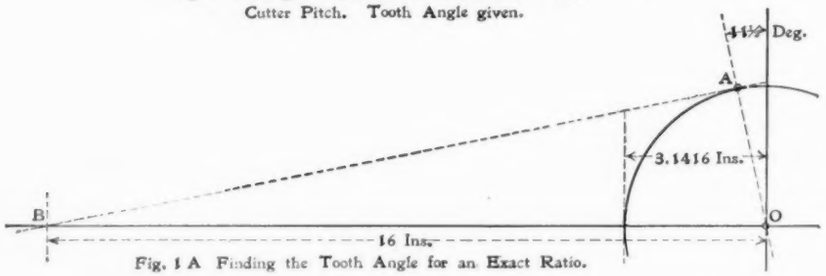


Fig. 1 A Finding the Tooth Angle for an Exact Ratio.

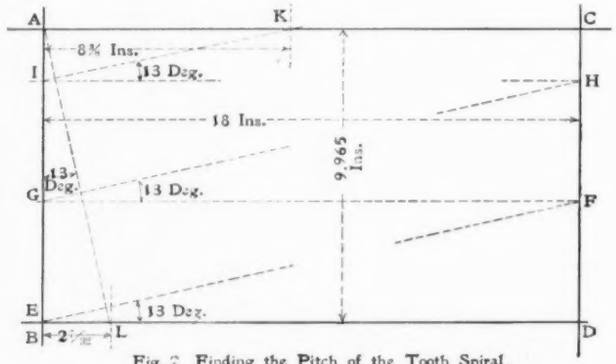


Fig. 2 Finding the Pitch of the Tooth Spiral.

American Machinist

Probably the infrequent use of spiral gears for angular transmission is due mainly to the common belief that such gears are difficult to draw, and require special cutters for the correct shaping of their teeth. This view is correct in theory only; in practice it is much, very much, easier for both the draftsman and the gear cutter to produce the spiral gear, and for the assembler to place the same in the completed machine.

The bevel gear, as is well known, must have special cutters and a special form of machine in which to use the cutters, to give anything like stillness and general satisfaction at any except very moderate speeds. Quite differently, spiral gears not at all approaching mathematical exactitude in tooth shape or in position, will turn at the rate of 3,000, 6,000 or 10,000 revolutions per minute without noise, jar or undue wear, and the spiral gear teeth may be cut with the ordinary diametral pitch spur gear cutters which are now to be found in the toolroom of every shop making a pretense of modern equipment.

To make this matter perfectly clear, so that he who runs may read, and so that machine designers of the most ordinary attainments only, may be enabled to produce these spiral gears quickly and cheaply and have them run to their entire satisfaction, a single example will be shown, carried through the drawing room and machine shop, and no reference will be made to the mathematics or the theory of the problem, save to say that all spiral gears of this description are really plain spur gears, in so far as having teeth and spaces of uniform section in both gears goes, much as the teeth may appear to the eye and the imagination of the draftsman to differ from regular forms and from each other.

The problem selected is such that the exact numbers of teeth and the exact spirals demanded cannot be had with regular diametral pitch cutters, or be cut on the Brown & Sharpe index machine, on which the cutting was actually done, and hence shows very clearly the large variations from correct tooth numbers and forms which yet produce absolutely perfect action in the finished product, so far as stillness, smooth action and durability go.

With a center to center distance of 3 11-64 inches between shafts at right angles to each other, a pair of gears cut with 16 diametral pitch Brown & Sharpe involute gear cutters, are to be fitted to give a ratio of relative shaft velocities of about 5 to 1, both gears to be of the same pitch diameter, and to be made from the same pattern.

The pitch diameters of this pair of gears are 3 11-64, and the pitch circumference = 3 11-64 × 3.1416 = 9.965 inches.

The sum of the angles of the teeth in a pair of spiral gears always equals 90 degrees, if the shafts are at right angles and the gear with the smaller angle is the slower. For the slow gear assume a tooth angle so small that it need not much influence the tooth thickness. In this case 13 degrees tooth angle was assumed for the slow gear, which makes the tooth a very little thinner than normal. The circular pitch of 16 diametral pitch, per Brown & Sharpe's book—which is on every draftsman's table in the United States, or should be—is 0.196 inches, and the pitch circumference being 9.965 inches, gives $\frac{9.965}{0.196} = 50\ \frac{165}{196}$ as the correct number of teeth, which is an impossibility; hence as the teeth are known to be a little thin, say 50 teeth, making the teeth a little thicker, instead of 51 teeth, which is nearer right, but is an awkward number and would make the teeth yet thinner. Pay no attention to the discrepancy, it makes no difference in the result. Use 50 teeth in the slow gear. The ratio is to be about 5 to 1, and the angle of the teeth in the quick gear must be 77 degrees if the angle of the teeth in the slow gear is 13 degrees, because the sum of the two angles is 90 degrees, and 90 — 13 = 77 degrees.

Construct Fig. 1, in which the horizontal line *B O* is intersected at *O* by a perpendicular, and with *O* as a center and 3.1416 inches as a radius, describe an arc of more than 90 degrees, cutting the horizontal and perpendicular lines. 3.1416 inches is the circumferential pitch of the teeth in a 1-inch diametral pitch gear, and since in this case a 16 diametral pitch tooth is to be cut, the drawing is, so far, on a scale of 16 times the full size. If the required tooth were 10 diametral pitch, then the drawing would be 10 to 1; if 4 diametral pitch, 4 to 1; if 24 diametral pitch, 24 to 1, and so on. If a larger scale is wanted, then take 6.2832 inches for the radius of the arc, which doubles the scale of the drawing. Now set a bevel T-square to 13 degrees, and be sure this setting is pretty nearly right. Draw *A O* and *A B* at right angles to *A O*, intersecting *B O* at *B*. The distance from *B* to *O* will then be 16 times the circumferential pitch of the teeth in the quick gear, which

is to drive the 50-tooth wheel of equal diameter previously determined upon. $B\,O$ in this example scales 14¼ inches, and $\frac{14\frac{1}{4}}{16} = 0.89$ inch, which is the correct circumferential pitch of the slow gear teeth. This gear is specified as having a pitch diameter = 3 11-64 inches, giving a pitch circumference of 9.965 inches, and $\frac{9.965}{0.89} = 11\frac{7}{8}$ teeth in the quick gear—say 11 teeth; never mind trifles. $\frac{50}{11}$ does not give a 5 to 1 reduction; it gives a little more than 4½ reduction, which answered the purposes of this occasion just as well. The tooth angles may be varied to make an exact ratio approximation, but in this case "pretty near" was just as good as anything.

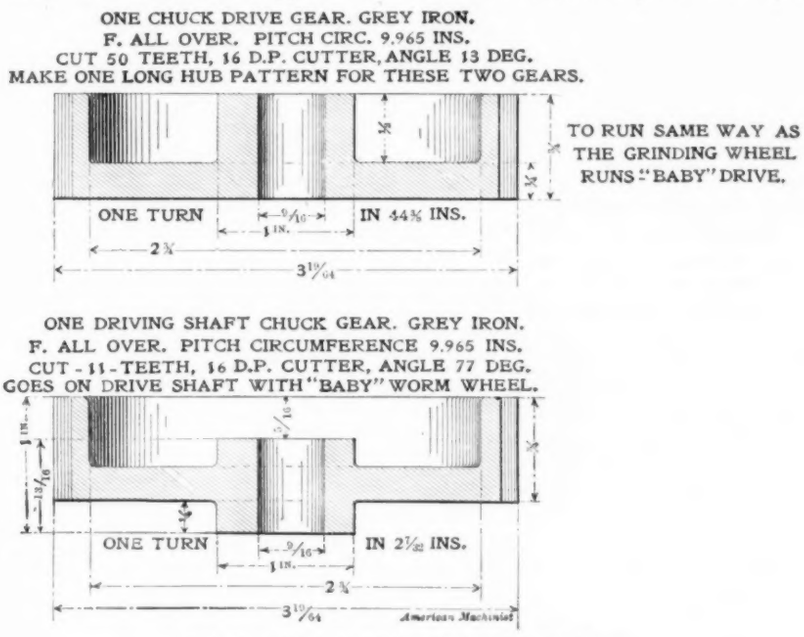

ONE CHUCK DRIVE GEAR. GREY IRON.
F. ALL OVER. PITCH CIRC. 9.965 INS.
CUT 50 TEETH, 16 D.P. CUTTER, ANGLE 13 DEG.
MAKE ONE LONG HUB PATTERN FOR THESE TWO GEARS.
TO RUN SAME WAY AS THE GRINDING WHEEL RUNS "BABY" DRIVE.
ONE TURN
IN 44⅜ INS.
2¾
3 19/64
ONE DRIVING SHAFT CHUCK GEAR. GREY IRON.
F. ALL OVER. PITCH CIRCUMFERENCE 9.965 INS.
CUT 11 TEETH, 16 D.P. CUTTER, ANGLE 77 DEG.
GOES ON DRIVE SHAFT WITH "BABY" WORM WHEEL.
ONE TURN
IN 2 7/32 INS.
2¾
3 19/64
American Machinist

FIG. 3. WORKING DRAWING OF THE GEARS.

This particular job was for a special grinding machine to drive the work holding chuck, the work not having a very great diameter variation, and so, as was supposed, needing only one speed instead of the 14 or more work chuck speeds to be had on the Brown & Sharpe universal grinder. The matter had been considered by a good grinding machine hand, who reported that a reduction by this pair of gears of from 4 to 5 to 1 appeared to be about what was needed, and as the first guess of 13 degrees slow gear tooth angle gave a reduction ratio of 11 to 50, it was passed as O. K.

In case an exact ratio is wanted, the number of slow-gear teeth must be a multiple of that ratio. In the present case the slow gear has 50 teeth $= 5 \times 5 \times 2$ and the whole number of reduction ratios possible are 50, 25, 10, 2. For a 50 to 1 reduction the quick gear would have one tooth in the form of a single thread worm, 0.196 inch pitch, which will move the slow wheel having 50 teeth one tooth for every turn of the worm. For the 25 to 1 ratio this 0.196 inch pitch worm would be changed to a double-thread worm having 0.392 inch pitch. For the 5 to 1 ratio the quick gear must have 10 teeth, which is the same thing as a 10-fold worm, and the correct pitch circumference would be $0.196'' \times 10 = 1.96$ inches. But in the example under consideration the pitch diameter of the quick gear is not correct for a whole number of teeth; it is actually 9.965 inches. Dividing 9.965 inches by 10, the number of teeth required in the quick gear for an exact reduction ratio of 5 to 1, gives 0.9965 inch as the available pitch.

Now construct Fig. 1A, which is the same as Fig. 1 as far as it goes. Since the scale is 16 to 1, same as in Fig. 1, multiply the faulty available pitch 0.9965 by 16 = 15.944 inches and set off 15.944 inches, $B\,O$, Fig. A1; to save bothering with the fraction, call the 15.944 inches even 16 inches, which will make no working difference in the result, and set the bevel T-square blade tangent to the arc at A, Fig. 1A, and cutting the base line $B\,O$ at B. This angle is about 11½ degrees, and is the angle of the slow-gear teeth. The angle of the quick-gear teeth will of course be the complement: $90° - 11\frac{1}{2}° = 78\frac{1}{2}°$.

Where exact ratios are required, it is sometimes impossible to use a pair of gears of exactly the same pitch diameters, but by changing the diametral pitch of the cutter and "hogging" the dimensions, it is very rarely the case that gears of the same pitch diameter cannot be made to give the ratio wanted.

It will thus be seen that where exact ratios are demanded the method is to first find the pitch of the quick-gear teeth, as previously indicated, and set off this pitch multiplied by the scale of the drawing on the base line $B\,O$, instead of first assuming the angle of the slow-gear teeth and then making the T-square blade give the pitch of the quick-gear teeth on the base line $B\,O$. The two methods are simply the reverse of each other in the order of operations, and this prolix, and to the expert in spiral-gear drawing undoubtedly tedious, detail of the two methods is given solely for the benefit of cubs, draftsmen and others to whom a spiral gear appears as a thing of mystery veiled in clouds of figures and abstruse formulas, instead of being what it really is—about the easiest thing to draw that the drawing room is called upon to produce. The diagram, Fig. 1, can be laid down and the angular lines drawn and all the figuring done inside of half an hour by anyone familiar with the first four rules of arithmetic and the drawing board, and no accuracy is required except in the figures and the angles. The figures should be without error, and the T-square angles should be close to right.

To find the spirals at which the Brown & Sharpe index machine is to be set to cut these two gears, draw Fig. 2, consisting of two vertical lines any convenient distance apart and cross these two verticals with two horizontals, which are the pitch circumference of the spiral gear to be cut apart from each other. If an 18-inch paper scale is on the drawing board, place the verticals $A\,B$, $C\,D$, 18 inches apart; by the conditions of this particular example the horizontals $A\,C$, $B\,D$ are 9.965 inches, the pitch circumference of both the gears apart. This completes the figure ready to find the lengths of one turn of the spirals on which the gear teeth are to be cut. Next, with the T-square blade set at 13 degrees, draw the inclined and horizontal

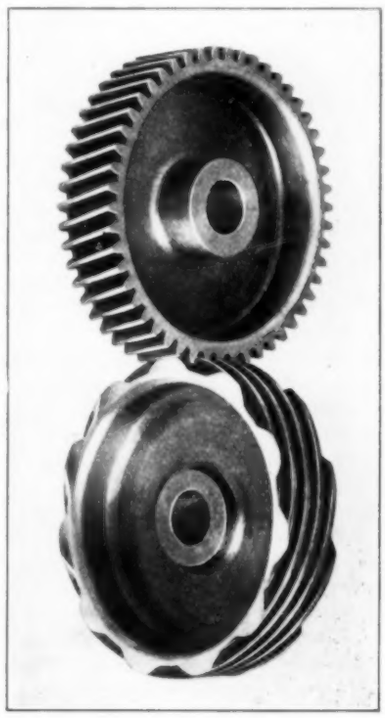


FIG. 4. THE COMPLETED GEARS.

dotted lines *E F, F G, G H, H I, I K,* until an inclined line cuts the top horizontal line. Then 18 inches multiplied by as many inclined lines as there are, plus the horizontal scale measurement of the residual *A K,* is the one turn length of the correct spiral for the 13-degree teeth. In this particular case it is 44⅜ inches, but the nearest that can be had on the Brown & Sharpe machine is 45 inches, hence the slow gear was cut with one turn in 45 inches.

To obtain the length of one turn of the spiral for the quick gear having the bevel T-square blade still set at 13 degrees, draw the line *A L,* intersecting *E D* at *L;* then the distance *E L* is the length of one turn of the spiral for the quick gear, 2 7-32 inches. This gear was cut on the Brown & Sharpe with a spiral a few hundreths, only, too long. It will be observed that in all this drawing of Figs. 1 and 2 the bevel square blade is set at 13 degrees only, and is not moved at all.

Everything so far in this example is wrong, nothing is accurate or as it should be, exactly. Fig. 3 gives the detail drawing with instructions to the patternmaker and the machinist, and any sort of a draftsman ought to have the job in the shop in two hours after he begins it, if he draws on thin paper, which will make blueprints without tracing, as he should do.

The result of all these "hogged" measurements is a pair of gears, shown in Fig. 4, which have almost no clearance, run still at any speed, have a beautiful tooth bearing, and are so nearly correct in every way that the 13-degree angle gear will drive the 77-degree angle gear quite strongly, although it does not look as if it could possibly drive it at all.

The 77-degree angle tooth has, on the Brown & Sharpe machine, to be cut with an end mill, because the slide cannot be set to the angle for a regular gear wheel cutter.

These minute details are given in full to show how very easily these spiral gears can be used, and how little theoretical knowledge and accuracy are needed to make a thoroughly good job, far better than the very best bevel gear that can be produced, with tools found in every fairly well equipped toolroom.

Fig. 1 is all that is needed to lay out any gear of this class, and Fig. 2 gives the spirals with very little labor.

The editor of the "American Machinist" has seen these gears set up and running, and will say, undoubtedly, that all the assertions here made regarding the quality of the finished job are correct.

[Mr. Randol's article is undoubtedly an interesting illustration of the liberties that may be taken with spiral gears in certain cases. These liberties were not all, however, as large as he seems to think. Thus the calculated tooth angle for a speed ratio of with even diameters is 12° 25′, while the angle which was actually given by the milling machine was 12° 6′; which is not a very violent departure from accuracy. Again the calculated numbers of teeth for the conditions are 10.64 for the quick gear and 49.6 for the slow one, and the use of the nearest *larger* whole numbers 11 and 50 results in teeth which are a little thin and which thus drop into mesh and operate, the chief departure from the assumed conditions being a slight reduction of the center distance, which, with such fine teeth as 16 pitch, would not be serious, or perhaps even noticeable, except with careful measurement. In a case wherein the calculated numbers of teeth exceed those which it is necessary to use, or wherein coarser teeth are wanted, the situation would be very different.

The chief real liberty taken is in using the normal or cutter pitch for the circumferential pitch in the case of the slow gear, and this is possible because with the low angle the two pitches do not greatly differ. The error would increase with larger angles and with an angle of 45 degrees (and more spiral gears are made with this angle than probably with all others) the error would be 41 per cent. The diagram, Fig. 1, is certainly a neat way of finding the circumferential from the cutter pitch, and it may be remarked that as *O B* is 16 times the circumferential pitch of the quick gear so *O C* is 16 times the circumferential pitch of the slow gear. The radius of the arc compared with *O C* shows how small, in this case, is the error due to using the cutter pitch for the circumferential pitch in the case of the slow gear, but it is easy to see how this error would increase with an increase in the angle.—Ed.]

Letters from Practical Men

Cutting Worms or Screws on the Circular Saw.

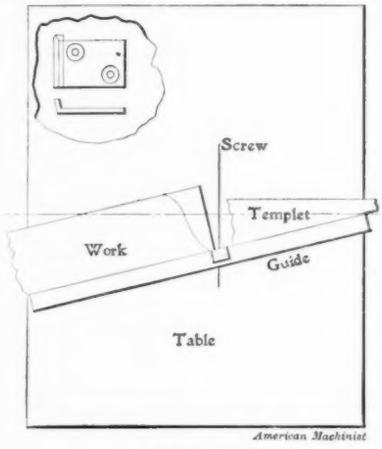
Editor American Machinist:

Many are not familiar with the operation of working out worms, conveyors or screws on the circular saw. Every patternmaker knows what a tedious job it is by hand, and the product of hand work cannot compare with that of the circular saw, to say nothing of the difference of time, which may be three or four to one.

The stock should be gotten out somewhat longer than required for the job, to allow for possible miscuts in the beginning. After turning to the proper diameter, square one end part way to the center, the better to guide the templet, which may be made of heavy paper, or, better still, of light cardboard, in the usual way. This should be wrapped around the end of the blank and tacked at frequent intervals, a block of wood being held against the trued end and the straight edge of the paper laid against it, to insure accuracy. Against the oblique edge of the paper templet now lay a flexible metal straight-edge, which also is tacked at the other edge to hold it in position. Remove the paper templet and you have an edge to guide a sharp knife in making a deep score in the wood, which is necessary for about one and one-half revolutions of the spiral. When the score is made the metal straight-edge is removed and the blank is then ready for the saw.

For the guide, take a piece of stock, about 2 inches thick, long enough to reach across the saw table, and of a hight equal to one-half the diameter of the blank. Taking the paper templet again, lay the straight edge of it square across the table, and against the oblique edge place the guide, clamping the ends to the edges of the table with the face of it one-half the diameter of the blank from the center of the saw when it projects about ⅛ inch above the table. Lower the saw and lay the blank against the guide, with the squared end near the slit in the table.

Take a piece of sheet metal about 1 x 3 x 1-32 inch, bend at an angle as shown, with the projecting part ground to a knife edge,



SAWING WORMS.

to enter the knife score. This piece is screwed to the guide.

On turning the blank it will of course move endwise. Use a stiff, sharp, cross-cut saw, which should be raised about ⅛ inch above the table. As the blank is turned against the guide, the saw will cut a score following the pitch as laid out with the knife. When the saw cut is carried around the blank and reaches the top of the guide, fasten a second metal bracket on the guide, similar to the first, with the edge filed to fit the saw cut nicely. Now remove the first bracket and keep turning the blank until the end is reached, when another bracket like the second is fastened to the guide in place of the one with the knife edge.

The saw cut is used as a lead for the subsequent operations of roughing out with a wabble saw on large work, and, until one side of some part of the thread is cut smooth, to be used in turn as a lead for finishing the opposite side of the screw, when the original score may be cut away. As the operation proceeds, various changes, such as tilting the table or slew-

ing the guide, will suggest themselves, according to the requirements of the work. Almost any screw or worm may be finished on the saw to such a point that only sandpapering in the lathe at slow speed is necessary to make a first-class job. After each cut is made to shape one side of the thread, the blank is turned end for end and the other side submitted to the same operation. In making large worms an additional guide at the back of the blank, without guiding brackets will give the operator better control of the work.

S. H. Ortway.

Told in the Shop.

Editor American Machinist:

Workmen do not always appreciate the niceties of other people's trades. We do not always prize at its true value the taste of the printer in the selection of type nor his discretion in the display of what is perhaps rather unpromising material. On the other hand, the printer doesn't see why the machinist need be so fussy about cutting sheets to a size: paper cut within an eighth of an inch is close enough for any one. We had occasion to have some tickets cut and printed by a local printer, and it was necessary that they should be cut to fit a certain slot. If they were too wide, they would not go in at all, while if they were too narrow they would slop around in a most unmechanical manner. To avoid this, we made a limit gage having two openings, one marked "go in," the other "not go in," and by requesting the printer to conform to this standard we very naturally expected our troubles were at an end. Having occasion to call in this gage we were surprised to find that the printer had ground the "not go in" side entirely off, leaving only one opening! Upon asking him why he did this, he replied that he "couldn't afford to cut up thirty or forty dollars' worth of stock and then find out that it was too wide to go in, and he ground off that side of the gage so that he would never know when he had made a mistake!" How would that kind of thing go in a machine shop?

A glib-tongued agent was trying to sell a scale to a rather reluctant customer and he had been all over his most convincing arguments again and again. "Why, sir," he said, "our scales are made in a modern shop, out of the best material—no scrap. The pivots are tempered steel, not chilled cast iron, as are some of the cheap goods. Our company makes scales and nothing but scales; we don't run plowshares, stove plate and scales all out of the same melt. I tell you everything about our goods is absolutely *first class*. Now, just look here, see how this platform bears on those knife edges—patent on that. See these levers that receive the load, they are of the second class and—" "Hold on, sir," said his wary customer; "you told me that everything about your scale was *first class*, and yet you now admit that the levers are *second class*, and I know enough to know that the levers are the vital feature of the whole scale. No, sir, you can't sell me any *second-class* goods!"

In a certain large shop of my acquaintance where the men are paid off by the envelope system it is the custom of the paymaster and his assistant to pass around among the workmen on pay day and hand out the money as they go along. The envelopes are kept on end in a shallow box or tray which is divided up by partitions into several compartments corresponding to the different rooms in the factory, and this box is carried about by these two men. This particular firm is also very strict about letting peddlers or agents into the works, so when a traveling vender of suspenders and "notions" attempted to enter he was stopped by the gatekeeper who informed him that this was against the rules. "Oh, well, that's all right," said the peddler; "but if you'll let me in I'll make it all right with you."

"Can't do it, anyhow," replied the gatekeeper; "can't let in any kind of a peddler."

"Aw, come off," was the answer, "I just saw a couple of fellers inside there peddling *garden seeds*, and if you can let them in you can let me in if you are a mind to!"

It is needless to say that the name "garden seeds" stuck to the paymaster's outfit, and he is always sure to dispose of his stock, in season and out of season.

W. H. S.

An Erector's Vise Bench.

Editor American Machinist:

The enclosed photograph is of a portable vise bench which we made for our erecting shop. It is very convenient and substantial, and may be of interest to some of the readers of the "American Machinist." We have six of them in use, and they have proven satisfactory. Each has an eye-bolt in the center, as shown, so that the crane can readily pick one up and carry it wherever a machine may be erected. The legs of the bench are of gas pipe, and these are cast into the pieces to which the 3-inch oak plank top is bolted. The bench has two drawers, as shown. The two legs on either side are cast into a piece which connects them at the top, and which is of tee section. That is to say, the side *A* is one piece and the side *B* is another, cast from the same pattern, and this piece extends along the side of the bench, connecting two of the legs at the top. At the bottom ¾-inch round iron tie rods connecting *A* and *B* are screwed into a foot-piece with right and left thread, or are put in plain and fastened with pins.

AN ERECTOR'S VISE BENCH.

Warren, Pa. A. A. Avery,
Gen. Foreman, Struthers, Wells & Co.

Drilling Glass.

Editor American Machinist:

I have watched with some interest the replies to Mr. Ridderhof's query, on page 866, "How to Drill Glass?" On page 975 "W." advises using diamond dust that costs $6 per carat. This will drill about fifteen holes 1 inch diameter; time 1¼ hours (according to his calculation), at 50 cents per hour, would make the holes cost 44⅔ cents each; rather expensive holes. Mr. Lamb—page 1060—advises the use of carborundum and the brass tube. Mr. Dennis—same page—is a little nearer the mark, but he fails to tell us what kind of a drill to use; he says "in the usual way." Now, what is the usual way—brass tube or flat drill? Then on page 1250 Frederick W. Turner starts off in way to lead you to believe he is going to "let the cat out of the bag," but after you have read the article through you begin to look gloomy again.

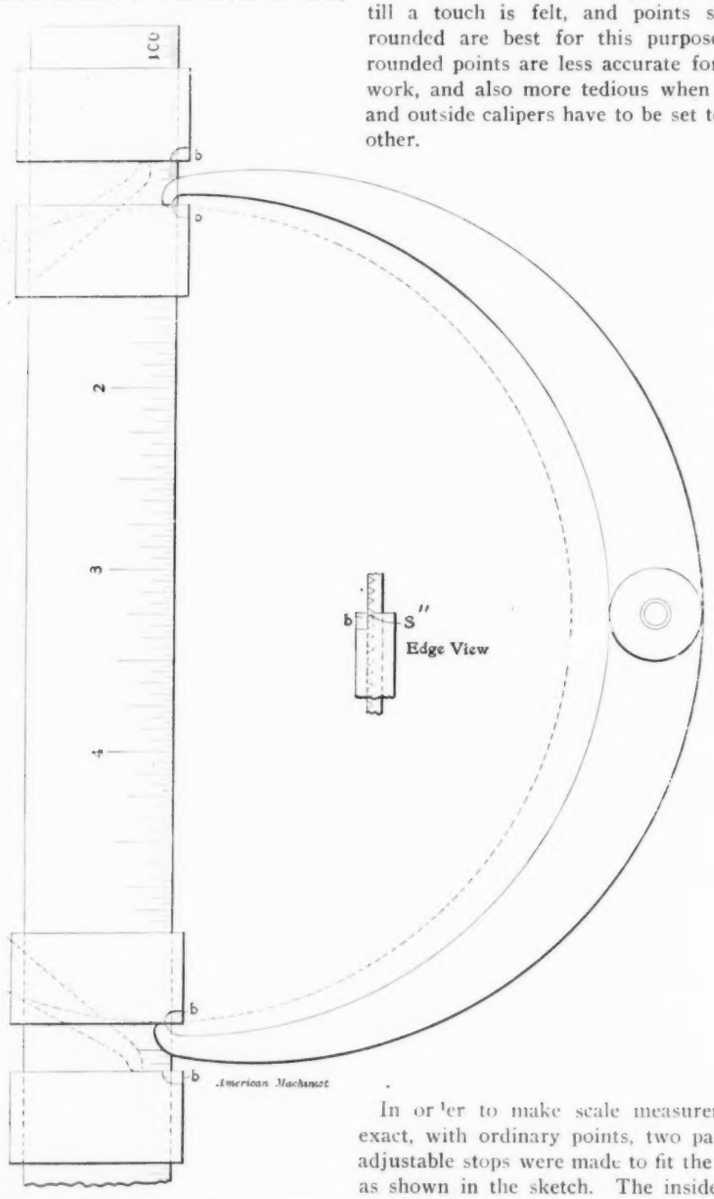
I would advise, for holes from the smallest up to ½ inch, to use a flat drill tempered in sulphurous acid. This will harden good steel so that it will cut glass without any lubricant; but to facilitate the cutting process use gum camphor dissolved in turpentine. For holes larger than ½ inch, first drill a ¼-inch hole, then use a tool made on the same principle as used to cut the holes in the flue head to receive the flues in a boiler. Of course this must run much slower than the brass tube is run, say about 25 turns per minute. I have drilled holes from 3-16 inch up to 1¼ inch in glass from double thickness up to ⅝ inch. A 1⅛ inch hole in ⅜-inch plate takes about 20 minutes. In a ⅝-inch plate I drilled a 1¼-inch hole in 30 minutes with an ordinary bit brace. This was done before a group of glass men to demonstrate that the flat drill and hollow drill were superior to the brass tube system. I do not hesitate to say that anyone who has never used gum camphor in turpentine would not believe the effect it has on glass. It works like magic. With a second cut file with this mixture you can file glass in any desired shape, and with as much rapidity as you can cut soft steel. If you can clamp a plate of glass to the face-plate of a lathe without breaking, you can turn it as you would metal with this solution.

Milwaukee, Wis. John Graves.

Aids in Setting Calipers.

Editor American Machinist:

The question as to how close to any given length a machinist ought to set his calipers, using a steel scale, led us to quite a discussion a year or so ago, and it resulted in our testing the skill of several lathesmen in this respect. Ten inches was selected to make the setting to, and the calipers were tested with a micrometer. The variation at first was about .01 inch, some being plus, other minus. Then the caliper points were squared up, making the corners sharp, when much closer measurements were made. Then it was found that by using a scale graduated in hundredths of an inch still greater accuracy was obtained than with coarser graduations, the lines being finer they could be more accurately split. It was also found that it was as easy to set to 10.005 inches as to 10 inches, for on the hundredths graduation the lines and the spaces are about the same width, making it as easy and as accurate to split one as the other. Much closer measurements were made, but the average would not justify one in saying that, with caliper points as generally used, the error would be much less than the breadth of the line on the scale. To set calipers accurately to the work, it is not necessary that the corners of the points be sharp nor parallel to each other, for they are adjusted till a touch is felt, and points slightly rounded are best for this purpose; but rounded points are less accurate for scale work, and also more tedious when inside and outside calipers have to be set to each other.



ADJUSTABLE STOPS FOR SETTING CALIPERS.

In order to make scale measurements exact, with ordinary points, two pairs of adjustable stops were made to fit the scale, as shown in the sketch. The inside corners of the stops *b b* are cut down flush with the top surface of the scale, and the edge is beveled off one-half the thickness of the line on the scale, as shown in the edge view at *s'*. If a pair of the stops are brought together, their beveled corners form a line the same breadth as those on the scale, and they can therefore be set exactly; then one stop can be slipped away and inside or outside calipers, as the case may be, set to the remaining ones. Lines and spaces are so closely split with these that 10.625 inches can be readily set, and there is not much guesswork in setting them to 10.5625 inches on the same graduation.

The outside calipers shown in the sketch were not drawn as they are because it is the easiest way, but because it is the way they ought to be made. The idea is to make the leg without any useless stock in it. The shape shown does that; they weigh less, take up less room in the tool chest, and are in every way more convenient than when part of the leg is made straight, as they usually are.

Youngstown, Ohio. J. H. DUNBAR.

Encouraging Suggestions.

Editor American Machinist:

I want to add a thought to the editor's note to "Drill Hand's" article, page 1252. Everybody isn't broad-minded or generous enough to welcome or appreciate a suggestion from one in an inferior position. How often do we meet men in charge that possess all the good ideas! I have had suggestions from apprentices that were of value that were used and credit given for them. I am not so sure that all the contributors to these columns are good mechanics, but they evidently are thinkers.

I would suggest to Mr. Reyner and Mr. Newton not to confine the use of tongues to brackets in pattern work, but to use them wherever they will add strength to joints in *any* pattern.

Referring to editor's note on page 1253, let us contributors be fair with Mr. Editor. I am sure he tries to be with us. We *all* err, as that is a trait of weak humanity. He edits the paper for the multitude, not for any one of us. Perhaps in one issue I will find several articles specially interesting to me, and again for several issues nothing to fit my special line of work, but always *something* worth reading. J. L. GARD.

[In a far western dance hall they hung up a sign: "Don't shoot the fiddler; he's doing the best he can."—Ed.]

Ways of Criticising.

Editor American Machinist:

As it is some time now since I sent in my first contribution to the "American Machinist," and as since the first was published I have seen a number of criticisms of its successors, I feel it my duty, as well as my right, to answer them; so for the present I free my mind from thoughts of tools, dies and fixtures, and beg leave to tell of a few things which perchance may interest others as well as myself.

Whenever I have the good fortune to do a job, or to see one done, which seems to me to possess novel and interesting practical points, I send it to the "American Machinist," thinking that as it has proved interesting and valuable to myself, it will prove the same to others. Often when the article has been published, some other mechanic, seeing it, has contributed an article showing another method possessing some one or more distinct im-

provements over the method described and shown in my article. Then another fellow has had his say, and the result has been that when I have had a job of that kind again I have been able to devise means, embodying the best features of all the methods, and by so doing, the highest possible efficiency in the tools constructed has been attained, and I and all other readers of the "American Machinist" have been the gainers. To those who contribute such articles, in which they confine themselves to the description of the use and construction, and at the same time point out where my methods may be improved or where they are defective, I am grateful, as these are "so e critics."

Now for the "others." One of them is the man who, instead of telling and showing how his method is superior to mine and pointing out the defects (if they exist) in a clear, practical manner, grows sarcastic and tries to be witty, and also asserts positively that the tool or device described in my article will not work, and this merely because he may know of a different method, or even because he never saw one as described in my article.

When a criticism on the lines of the above is published, I sometimes stop before the machine in which the dies or jig criticised (as the case may be) are working away and producing at a great rate, and I am dumb-founded. I must be dreaming! The tools are working! But no! that is impossible, for Mr. D—— says that they will not work! Strange! Well, he should know, of course, and I must not believe my eyes. But at any rate the dies stay in the press, and when a large order comes in for their product, I'll be durned if that fool of a toolmaker doesn't go and construct another in exact duplication of the first! Just think of it, and he a reader of the "American Machinist," too, and he knows that Mr. D—— says they will not work!

Then, again, we have the critic who says that the method or tool is old and obsolete, and insinuates that the writer of it has been asleep. This type of critic seldom or never contributes anything better, and if he knows a better way he keeps it to himself and spends his time ridiculing the efforts of another who is more willing to give the benefit of his limited knowledge to others.

Now, suppose the first article was not contributed; would the others ever have been? I think not. On the contrary, when an article describing a special method of manufacturing is published, it is usually followed by others, and at last we have several methods from which the readers of the "American Machinist" may choose the best.

Another thing: If every contributor, before sending in his contribution, made sure that his method or tool was the best and most up-to-date one in existence, how many contributed articles of this class would there be in the "American Machinist?" Now that I have had my say, I would suggest one thing, and that is this: Let critics confine themselves to pointing out the defects and the description of improvements without growing sarcastic or witty at the first contributor's expense; for this reason—that, in my estimation at least, the columns of the "American Machinist" are all too valuable for those who have gained admittance to them to use them for anything which does not help its readers in some practical manner, and this is not usually accomplished by witty sayings or sarcastic remarks. It is always good to remember that "a little fellow-feeling makes us wondrous kind."

JOSEPH V. WOODWORTH.

Small Shop Tools.

Editor American Machinist:

The incidentally overheard remark of a new employee to an older hand a few days ago has set me thinking on a subject of no small importance in machine-shop economy. After expressing surprise at the meager supply of small tools obtainable, he went on to say that he noticed that most of the toolmakers appeared to have a little private tool department of their own!

Now, is not this often the case, and should it be so? Is it a wise plan if a counterbore, arbor, reamer or what not is required, to have a man stop on his job to make it and when done with it to put it in his drawer? I think no one will admit this, yet it is done in a great many shops daily.

Even supposing he turns it into the toolroom, it is probably made hurriedly, out of any piece of scrap stock handy, with special reference to that particular job and not likely to be very useful on others. In other words, it is not made in harmony with that class of tools to which it belongs, in proportion or style. Would it not be better to have on hand such tools of which the use could have been foreseen, made preferably by those in the business—for these are days of specialists—or, if home made, designed in reference to others of its class, either by existing and readily obtainable formulas or by good examples, marked and finally stowed away in appropriate places provided for them, where they are readily accessible to any and all who properly have use for such a tool?

It is true that sometimes it will be necessary to have a tool so special in its character and proportions that it will not agree with the ordinary, but these cases are comparatively few, and even then the proper depository is the toolroom, where a record should be kept of everything, giving its various dimensions, purpose made for, where kept, and any other data considered desirable.

The private hoarding of small tools is not usually done for a selfish purpose, as it might at first seem, but rather may be regarded as a quiet, though expressive commentary on the tool system—or lack of it—in vogue; if the tool is in a workman's drawer, *he* knows where it is, and there, safe from abuse or loss, it will be found when again wanted, either to be used by himself or loaned.

Just how far into this question of the economical purchase or providing of small tools one is to go must needs be decided by each shop, according to its own particular purposes and ideals. Not long ago I was told by a representative of a prosperous concern that their small tool equipment had cost quite as much as their machinery; true, it was not a large establishment, yet there is considerable food for thought in the statement.

Reminiscently, it may be stated that thirty-five years ago twist drills and drill chucks were just becoming known; taps, dies and screw plates were yet mainly of foreign manufacture, and there existed no reliable standard regarding either pitch or diameter among them. A few stores carried a limited assortment of wire in coils, a few sizes of tool steel, sheet brass, carriage bolts, rough nuts and the like, both in quality and quantity entirely inadequate for modern purposes. Hardened, finished nuts, set, cap and machine screws were unknown to the trade; brass, copper and steel tubing was difficult to obtain, while rods of brass, iron, Bessemer steel and drill rods were not less so. Ready-made counterbores, adjustable and standard reamers, plain, angular and formed milling cutters, cheap hacksaw blades, hardened and ground lathe mandrels, patent lathe and planer tools, drop-forged wrenches, standard cut gears, screws, files, fine measuring instruments, and scores of other now-admitted necessities, were utterly unobtainable from stock and in many cases were unknown; hence it is well to remember that times change, and that what was once strict economy may now be questionable business methods.

The pertinent questions raised are, would not a moderate investment in solid wrenches be repaid by fewer damaged nuts? Would not more file handles save time in changing from one to another, and would not a less stinted allowance of waste and oil frequently prevent expensive friction in other things besides machinery, and, finally, would not a sensible supply of small tools save valuable time, as well as promote the comfort and convenience of the mechanics employed? W.

A Gang Corebox.

Editor American Machinist:

The six-gang corebox shown at Fig. 1, hinged and hooked on the ends, was used to make the cores for 3,888 round chambered holes cored to tap for and to clear 1¼-inch brass pipe. There were 324 cores to each of twelve composition castings, contracted for at 18 cents per pound, cost of pattern included.

It was figured that by making the cores

in gangs of six a coremaker could produce at least three times the quantity of work with this style of corebox, as if handicapped with the customary single type; and so it proved, but as the pattern was then made (see Fig. 2, at the left), the time consumed in setting the cores one at a time by the molder had been overlooked in the desire to speed the coremaking, and after a couple of hours had been spent in setting the cores for the first casting alone, it was decided to cheapen matters by substituting oval prints to span and connect six of the cores in one, through the medium of the print space (see Fig. 2, at the right), which necessitated altering the corebox to match, as shown in Fig. 1, on half *B B*, the other half *A A* showing how it was used for the first casting.

With the altered corebox and pattern the coremaking and coresetting were greatly facilitated, so that a fair profit was made on the job.

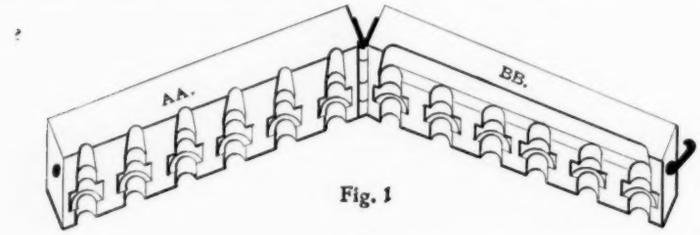


Fig. 1

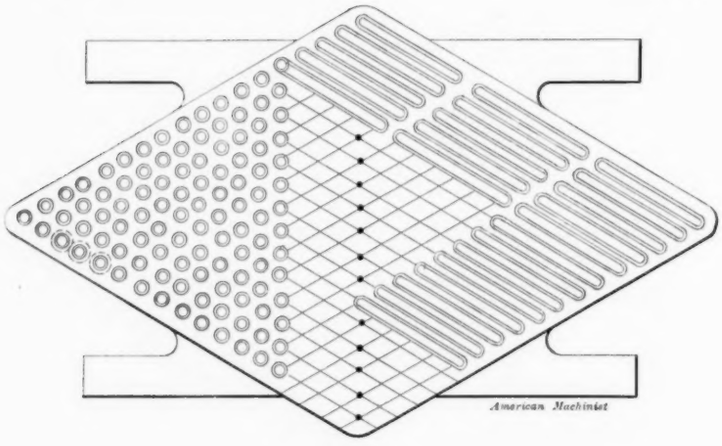


Fig. 2

A GANG COREBOX AND METHOD OF SETTING CORES.

The patternmaking on this condenser plate, which appears at first glance to be a "tir e killer," was done cheaply by having the 324 round prints made by an outside specialist in this class of work, at the rate of 3 cents a dozen, every one alike, with a hole drilled in the center of each to fit a No. 14 steel wire nail; this item alone afforded a considerable saving of time and money.

The spacing of the print centers was simplified by entering a pointed brad-awl at the intersections of lay-out lines, as shown at center, Fig. 2; then after placing nail in centering hole of print and again in layout holes in plate and driving home, each assumed its relative position without the doubtful aid of the usual scribed circle at the print base to set the same by, and even after it was decided to change the round prints for the oval, two out of every six of these holes in the plate were used to locate each end of the prints by drilling holes to match. The corebox was made 1-64 inch longer than the overall hight of the pattern, to allow the green sand cope to bind the cores firmly, as prints were used on the drag side only.

OLD BOB.

Nicking Screw Heads—Filling an Oil Can.

Editor American Machinist:

In a toolroom or a repair shop we often have to cut a screw-driver slot 1-16 inch, or 3-32 inch wide in the head of one or two screws. To rig up a milling machine is too much bother, to get a tool ready for the shaper takes too much time, the hacksaw blade is too thin, so we take a narrow chisel and chip the slot and smooth it up with a file. This, I suppose, is the experience with a good many of us. But the other day a fellow workman put me on a way that I accepted in a minute: Put two or three blades in the hacksaw frame. Most modern frames will take that many blades if you try, and the screws are done in a few minutes.

I have many a time seen men trying to pour oil into their oil cans from a 5-gallon can with an opening of 1½ inches and spill a lot of it. I told a fellow workman the other day to hold a small stick or the spout of his can at the 1½-inch opening and let the oil run along that and into his oil can, as the oil will follow the pointer very faithfully, and not a drop needs to be spilt. It is an old way and simple, but he had never seen it and was much pleased with it; so I thought maybe some of your readers may need to use it in an emergency some time, and, if so, they are welcome to it.

J. J. HAGELGREN.

Table of Minute Trigonometrical Functions.

Editor American Machinist:

In reply to a query from Mr. Wm. S. Rowell, on page 1111, asking for a table of trigonometrical functions giving values as low as one second, I would refer the gentleman to "Gauss Fünfstellige Vollständige Logarithmische und Trigonometrische Tafeln." This book gives sines, cosines, tangents and cotangents from 0 to 1 degree and from 89 to 90 degrees for every second; from 1 to 8 degrees and from 82 to 89 degrees for every 10 seconds, and from 9 to 82 degrees for every minute. In the back of the book is explained a method by which the functions down to one-tenth of one second can be figured, and, in fact, problems are given using one one-thousandth of a second. In using gages, it is obvious that the functions of a very small angle will be needed, hence for values near 0 and 1 degree the values are given for every second because the values of the sine near 90 degrees and of the cosine near 0 degree vary but little.

The book is printed in German, but anyone with a slight knowledge of the language can understand it. It also contains logarithms of numbers from 1 to 11,000, a table of constants, trigonometric functions, sums or differences of two numbers whose logarithms are given, natural logarithms from 1 to 1,109, natural functions for every 10 minutes, hights of arcs and lengths of chords, table of squares (conversely of square roots) and an explanation of interpolation. This book is one of the best I have seen in its line, and trust that it will meet a "long-felt" want."

L. A. STARRETT.

Turtle Creek, Pa.

Queer Information.

Editor American Machinist:

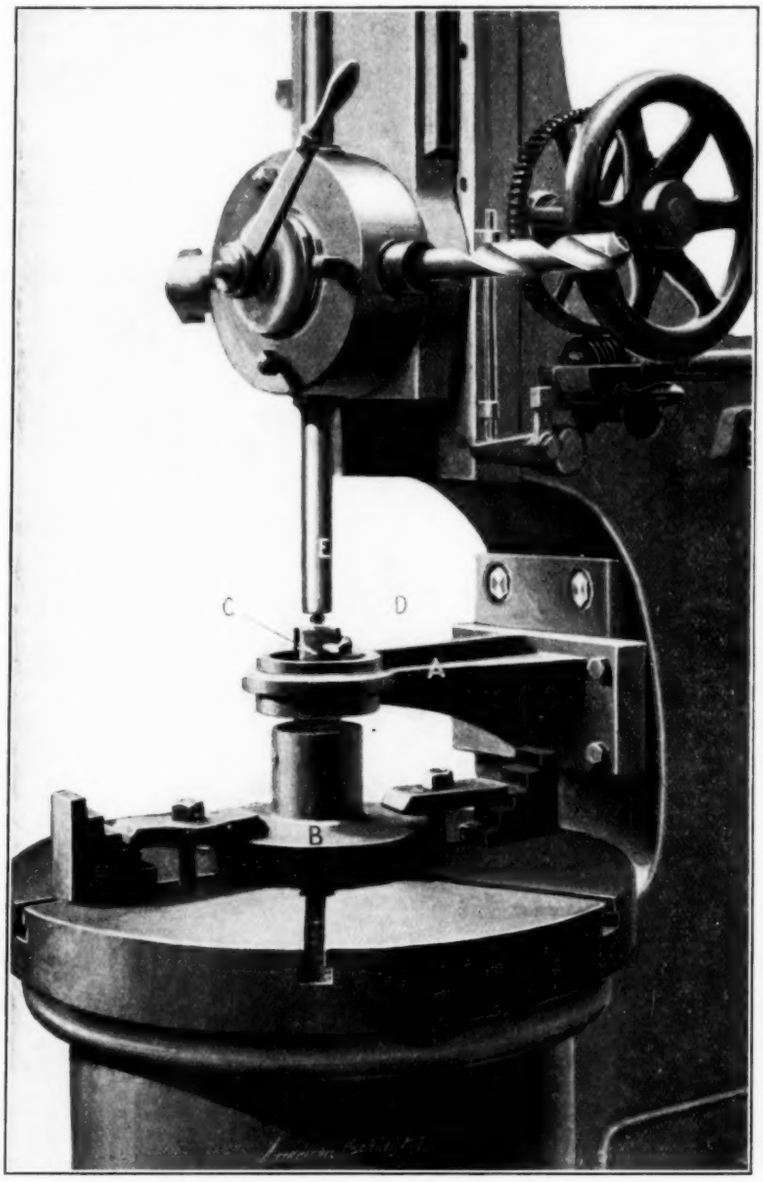
In a recent number of the "Shoe and Leather Reporter," under the title "Practical Shoemaking," are several paragraphs telling how needles are made. The writer says "it will be news to many that the eyes of needles are *either punched* or *drilled.*" Evidently there is a third way of making a hole. Can you advise me what it is? We are also gravely informed that "most needles are swaged, which is done on a *drop press,* although some needles are turned in a *special lathe* which has a hollow spindle." I wonder how many lathes it would take to turn out 250,000 needles per day, as is done by one of the leading needle factories in this country. "The shanks, too, are ground." Possibly because in the factory where the writer acquired his information they

were not aware that wire can be drawn with a fair degree of accuracy.

The old saying that "a cobbler should stick to his last" still holds good. Whenever I read such misinformation in a paper that purports to give accurate technical information, it reminds me of the stock question of the browbeating lawyers when cross-examining, "Is everything else you have sworn to is as true as your last statement?" ROBERT J. HEARNE.

and downwards in the piece *B*. So, to bore the bracket *A*, we fix the piece B on the platen of the machine. We fix the tool *D* properly and run the machine. The shaft *C*, and consequently the tool *D*, goes downwards by the pressure of the piece *E* which has the automatic advancement of the feed. The boring is so done with the greatest facility and is sure to be in accurate alinement. ARTHUR BOLLINCKX.

Brussels, Belgium.



BORING A BRACKET FOR THE BORING MILL.

Boring a Bracket for the Boring Mill.

Editor American Machinist:

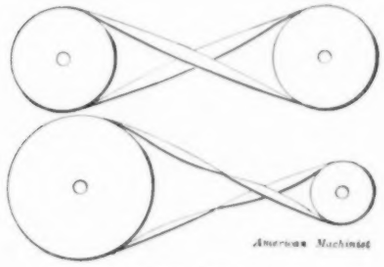
I send you enclosed a photograph showing the idea of one of our foremen (Mr. de Haseleer) for the boring of the bracket which we placed on a Richards vertical boring mill. The piece *B* has a fixed key to drive the shaft *C* in which is the tool *D*. The shaft *C* may be moved upwards

Cross Belts.

Editor American Machinist:

What are usually known as cross belts are very common in driving machinery, and it is a well-known fact that they run best when the two pulleys which they connect are somewhere near of one size. But sometimes it is almost necessary to use a cross belt on pulleys of very different diameters, and it does not seem to be generally known how this may be done and still have the belt run smoothly.

If the belt connects two horizontal shafts on the same level, and is given the ordinary single turn or twist, it will naturally stand in a vertical position at a point midway between the two shafts. Now, if the two pulleys are nearly of one size, this midway point is the natural crossing place for the two parts of the belt and all goes well. But if one pulley is much larger than the other, then the belt must cross at a point much nearer the small pulley than the larger one, and with the ordinary twist the two parts of the belt are apt to quarrel, so to speak, at this point. To remedy this in many cases, it is only necessary to give the two parts of the belt an extra twist as they pass from one pulley to the other. The belt then will stand vertical at two



CROSS BELTS.

points, marking the thirds of the distance between the shafts, and if the pulleys are of such sizes that the belts cross at or near one of these points they will run smoothly again and with very little friction. The sketch shows the two positions.

J. C. GREEN.

Hackettstown, N. J.

Marking and Keeping Small Twist Drills.

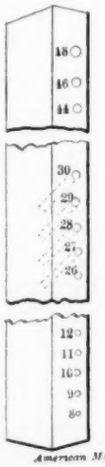
Editor American Machinist:

On page 1250 Mr. Lachmann tells how to prevent the marks on twist drills from being obliterated by the marring of the chuck. As this is a very practical subject in every iron-working shop, I will follow it up a little, and before I get through I will tell you how we do it. Mr. Lachmann files a flat spot on the shank and there restamps the necessary figures. This is a step in the right direction, but on small drills, where we have the most trouble, this weakens the shanks, and, moreover, our shop cannot boast of the tools to stamp the figures on these small drills, say, from 3/8 inch down, of which we use the most. I have often wondered why drill manufacturers do not have perception enough of the needs of the case to stamp the fractions now in use, as far from the end of the shanks as possible, where they would stand some kind of a chance of preservation, and I have noticed with pleasure that some makers are using decidedly large figures, in marked contrast with the very small ones that we often see, or *try to see*.

Right here I want to ask, why it is that

drills for machinists must be marked with fractions, when on other drills and boring tools they are conveniently avoided? The common "bit stock drills" of the market advance in their sizes by thirty-seconds and are marked by simple figures indicating the number of these thirty-seconds. In like manner "auger bits" for wood ordinarily advance by sixteenths, and are very properly stamped simply by the number of these sixteenths. Now, our drills advance, ordinarily, by sixty-fourths, and if manufacturers would simply stamp them with the proper number of sixty-fourths, we would soon get used to it, and a great amount of confusion would be avoided.

I speak advisedly on this subject, for about ten years ago I made a drill rack for our shop running from ⅛ to ¾ inch, and simply marked the places for the drills 8, 9, 10, 11, 12, etc., and told the men that this meant the number of sixty-fourths of each drill, and I was surprised to note how quickly they "caught on" and how soon, in shop parlance, the old fractions were dropped and all drills were designated simply by the numbers on the rack. A ⅜ inch drill was no more a ⅜ drill, but a No. 24 drill, and a 25-64 inch drill was no more a 25-64 inch drill but simply a No. 25 drill, etc.



A DRILL RACK.

The great improvement of this system over the old is never more manifest to me than when I am called to make out orders for new drills, and must again go through the fourths, eighths, sixteenths, thirty-seconds and sixty-fourths of the lists.

To get the best results from this drill rack, it should be in a very handy position to reach by the drill man, and someone must see to it that the places for the drills are *all* and *always* kept full, so that there is never but one vacancy at a time in the rack, and this for the drill that is in the chuck. If any drill gets lost and cannot be immediately replaced, or if it must be carried to some other part of the shop, then its place in the rack must be temporarily filled by a nail or a peg or anything that will keep any other drill out of this place. If this system is carefully carried out there is no occasion for the machinist, in ordinary practice, to look at the marks on his drills any more than there is for the compositor to look at the face of his types when he is setting and distributing them. In our shop a plainly marked drill gage hanging by the rack completes the outfit, so that if any doubt arises as to the size of a drill it can be quickly settled by the gage without searching for the marks on the drills, which, as a rule, cannot be found after they have been in use a short time.

As I have not seen a better or cheaper drill rack than the one that has been in daily use by us for the past ten years, I send a sketch of it without the drills. It is made of a piece of 2x3-inch pine fence railing, fastened in an upright position at the right of the drill press with holes for the drills as indicated, each hole being bored with a drill one or two sizes larger than it is intended to accommodate. After the holes were made it was taken to the pattern shop, the marks of the machinist's hands were planed off, and it was given three or four coats of shellac varnish, the figures being put on after the first or second coat; shellac being proof against the oils and dirt of the machine shop. As will be seen, this rack advances by sixty-fourths up to ½ inch, and above that by thirty-seconds, this being thought sufficient for our use. The dotted lines near the center of the sketch indicate the angle at which the holes are bored.

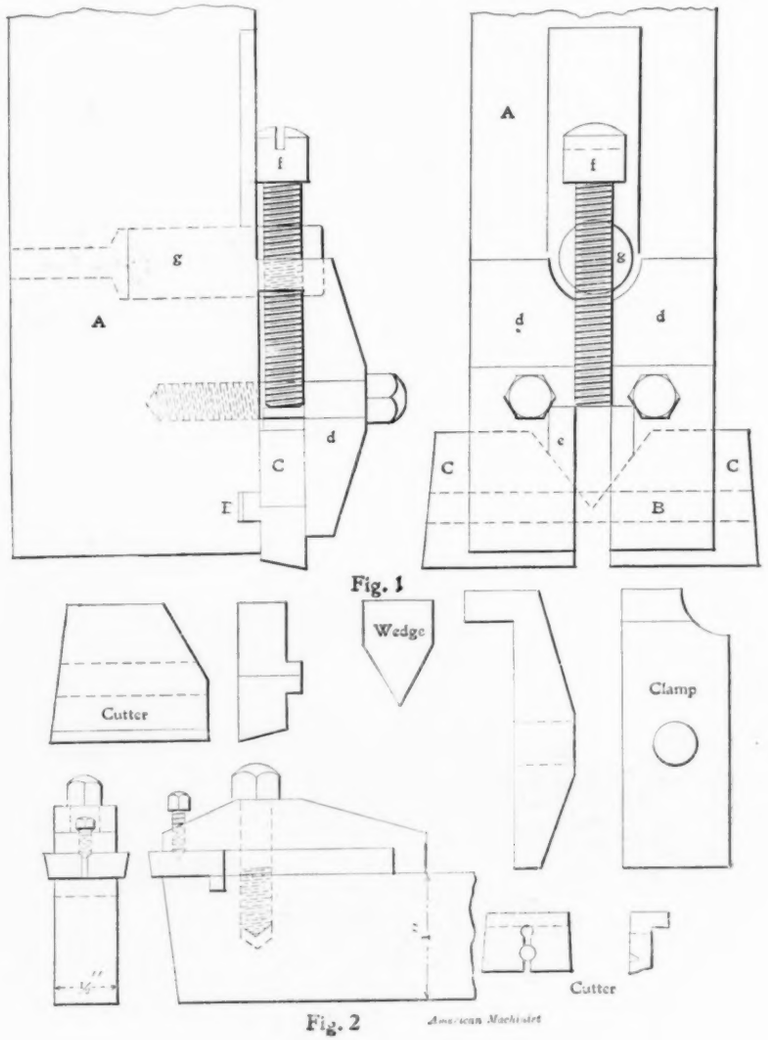
This is an age of improvement all along the line of machine tools, and I look for the time when every drill press that goes from its maker will be accompanied by a plainly marked drill rack, suitably attached to the machine, and when makers will vie with each other in making this rack as convenient and useful as possible.

Hackettstown, N. J J. C. GREEN.

Expanding Cutters.

Editor American Machinist:

The expanding cutter described on page 870 is one of those happy solutions of a problem we have all grappled with, but have generally left unsolved. How to enlarge a boring bar cutter to compensate for wear, I could never see, but with a planer tool I have had better success. In the sketch is shown a portion of a tool bar *A*, Fig. 1, of 1⅞-inch square machinery steel. In this bar, ¼ inch from the end, a groove *b* is cut ¼ inch wide and 5-32 inch deep. A corresponding tongue on the cutters *c* fits into this groove. Clamps *d* bind the cutters in position. The wedge *e* forces the cutters outward, the screw *f* being used to press the wedge down; *g* is a piece of cold-rolled steel driven into *A*, the small hole being drilled through *A* for driving out.



EXPANDING CUTTERS.

In using this tool, suppose you have a cap to fit 2½ inches wide. Set the cutters

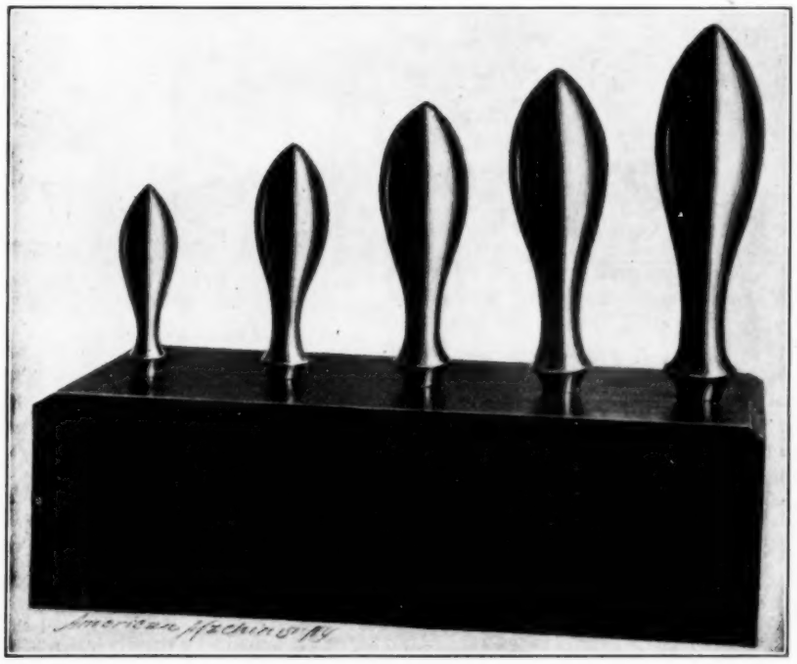
1-32 inch under size, clamping lightly. Then set down the screw *f* until a 2½-inch gage or micrometer calipers set to 2½ inches will just go over the cutters, and clamp tightly. With one pair of cutters 31-32 inch long any size may be obtained between 2 and 2½ inches.

For small work, a cutter made the same as the one shown for horizontal boring in Mr. Pilton's article may be held as shown in Fig. 2 and used in a lathe, shaper or small planer. A hole tapped in the front end of the clamp receives a small set-screw, the point of which, entering the countersink in the cutter, expands it to compensate for wear. JOHN SCOTT.

Standard Machine Handles.

Editor American Machinist:

We recently sent you a diagram giving the proportion of standard handles, which appeared at page 1007, and thinking that perhaps some of your busy readers would not take the time to study out the proportions given, even if they read the article, we have had photographs made from a sample set of these handles, copy of which we send you by this mail, and which shows to the eye at a glance the proportions of the same.



STANDARD MACHINE HANDLES.

It is hardly necessary for us to add any word further, except to say that if each dimension of the smallest one were doubled it would give the corresponding dimensions of the largest one, and of course the intermediate size would be in the same ratio.

Trusting that you may find space in your valuable paper for this illustration, we remain, UNIVERSAL MACHINE CO.

Z. R. TUCKER, Treas.

Providence, R. I.

Double-Pointed Center Punches.

Editor American Machinist:

The discussion, on page 1109, of a double-pointed center punch, recently patented, reminds me of the days when I made cutting dies for sheet brass, etc. We made them in a great variety of shapes, for novelty works and others. The pattern was placed on the polished steel blank and marked off with a scratch-awl; then a row of ⅛-inch holes were drilled close to the contour line and the center part was removed by breaking through the thin partitions between the holes. I had thousands of such holes to mark off, and I found it a very tedious job, for it was necessary to do it carefully, not to leave too much chipping and filing to be done afterwards. I believe the inventor of this double-pointed punch must have had similar work to do, for it seems that his device would be very useful on that class of work. It can readily be used as a pair of dividers to mark the right distance from the scratch-line, while it no doubt will produce the desired spacing with accuracy and dispatch. J. BEGTRUP.

Saving Ninety-Five Per Cent. on a Job.

Editor American Machinist:

I have been a close reader of the "American Machinist" for a number of years, and I have noticed lately that there has been scarcely an issue that has not contained one or more articles on punches and dies. The majority of them are nicely gotten up, and I have been greatly interested in and benefited by reading them. Another thing that I have noticed is that they are all for sheet metal. I do not recollect having seen any for other purposes. This brings me to the point of my letter.

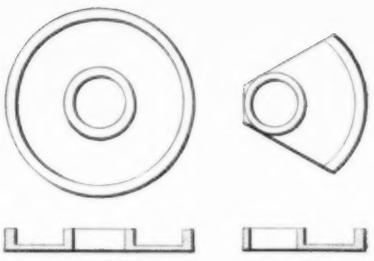


Fig. 1 Fig. 2

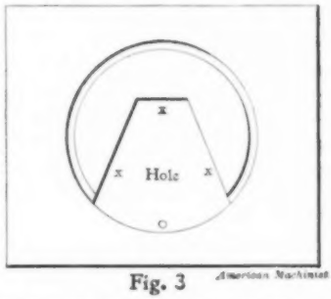


Fig. 3

PUNCHING INSTEAD OF SAWING.

What I want to say is, don't stop at sheet metal. If I had the money that could be saved from the work that is being done otherwise than with punches and dies which could be done with them, I could take my dog and gun and go out into the country and forget that I ever had to work.

I want to give an illustration of how I found one job being done without punches and dies. Fig. 1 (full size) was being produced in the turret lathe from 1-inch cold-rolled steel. Fig. 2 was the shape of the piece wanted, and they were required in lots of 10,000, so the job was of some importance. The turret operation I thought was all right, but then I got to the milling machine and saw the fellow sawing those sides off. He had a nut arbor in the dividing head; he would put one on, saw three sides and take it off. He was getting $1.50 per day, and 150 a day was all he could do. I thought that was pretty near crowding it. Well, it was plain enough to me that that one operation was costing us $100 on each lot. When the superintendent and I got together I inquired about the sawing operation, and was told that they always did it that way. I remarked about the expense of the operation, and ventured to say that I thought I could make a punch and die that would do the job. He did not get very enthusiastic about it and did not think I could cut the ⅛-inch rim, but I was stubborn and finally I got his consent to let me spend a half day on the job, and I went ahead.

I chucked a blank die in the lathe, sunk a ring recess in it, like Fig. 3, 1-16 inch wide and 3-32 inch deep, removed it from the lathe and cut out a hole the shape of the piece wanted, then got out a punch to fit the hole, and the job was done. The

punch had only to cut the three sides marked *x;* the side *o* just slipped through. I placed it in the press, dropped a blank into the recess of the die with some good lard oil smeared on it, brought the punch down on it, and the piece we wanted came out cut as clean as though it were sheet brass. The scrap was picked out of the die by hand. I ran through a handful and went and found the superintendent; in the meantime the boy was putting them through like an automatic press. The superintendent was more than pleased, but it was a joy forever to see the manager when he saw those things falling through that die. There was no burr left to file off. It was one of those operations that had worried him. Now, to finish the case, the boy put through 10,000 in two days, at 50 cents per day. The die and punch didn't cost over $4.00, so we saved $95 on the first lot. If I could find a job like that every month I would be earning my salary.

Now, boy, just take a look around the shop. You will find lots of small brass castings that are having holes drilled in which might be punched, places milled which might be done in the same way. Try it once. A strong stripper and a coat of vaseline will do the business.

H. H. LEHMAN.

Detroit, Mich.

A Cutting-off Device for the Shaper.

Editor American Machinist:

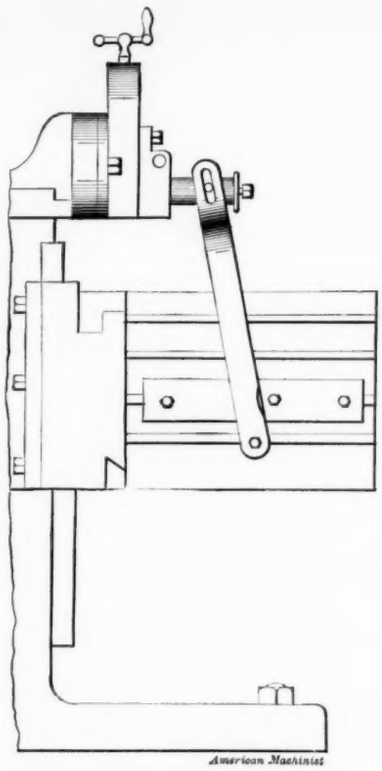
The sketch shows a device which I adopted for shearing 3,000 pieces of ½-inch copper wire 10 inches long in the shaper. The design is not original, as I had seen the arrangement used for a different purpose.

A forked lever pivoted at its lower end on a bolt secured in a Tee slot of the shaper knee has its upper end straddling the tool post and a piece of ¾-inch round steel held in the tool post, the slot of which is placed horizontal, extends through slots in the fork. A piece of flat tool steel is bolted to the side of the knee with a hole the size of the stock to cut. There is also a hole through the knee from side to side, and the stock is fed in from the farther side. An angle iron (not shown) is bolted to the knee with an end extending in front of the hole in the die, to serve as a length gage. By the motion of the ram the lever is moved back and forth past the hole in the die, and stock is fed through the die on each back stroke of the lever. C.

An Adjustable Hand Screw-Plate—English and American Cast Iron.

Editor American Machinist:

I send a sketch of a screw-plate the cutting edge of which can be detached and ground when dull. It may not be new, but I do not remember seeing it described previously. We have found it very useful, more especially so on screws which have been nickeled, as these latter cause an ordinary screw-plate to wear out very



A CUTTING-OFF DEVICE FOR THE SHAPER.

rapidly. Referring to the sketch, chaser *A* is let up into the boss of plate *B*, and the required size drill is then put through. The chaser must be let up just far enough to take a full thread on its end when the hole is tapped. Clearance holes, as usual, are then drilled through plate *B*, but no lead is given to the thread, that part of the tool acting merely as a steady and guide. The chaser *A* is taken off and hobbed from its thread at an angle, to give a slight cutting clearance. To keep the size and pitch correct when putting the chaser in place again, a screwed gage or plug must be used. *C* is an adjusting screw; *D D* are clamping screws; *E E* raise the cutting edge to the center as it is ground away from the top. Slots *F F* allow adjustment.

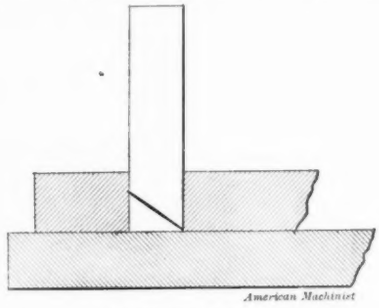
The editorial on page 1087 on the relative hardness of European and American cast iron is most interesting, and the opinion of more of the boys who have had opportunities of comparison on both sides would help to throw light on the subject. The majority here can of course speak only of their experience while handling imported material, such as, say, machine tools. We have a plant composed almost wholly of American machine tools by eminent firms. These have all been built within the last three years, and in making repairs and alterations we find it a fact that the cast iron of which many of their parts consist is undoubtedly a great deal softer than the British iron we are called upon to work up. As there are probably a number of cases similar to this, it may go some way to account for the general belief (over here at least) that American cast iron is softer than British.

S. C. REWPLATE.

Transferring Holes.

Editor American Machinist:

Having had occasion to transfer several ⅝-inch holes on to a plate and not being able to get at them with a "scratch awl" or scriber, I simply took a piece of ⅝-inch round cold-rolled steel and ground the end as shown; then, by chalking the surface of plate and by rubbing it over with the bare



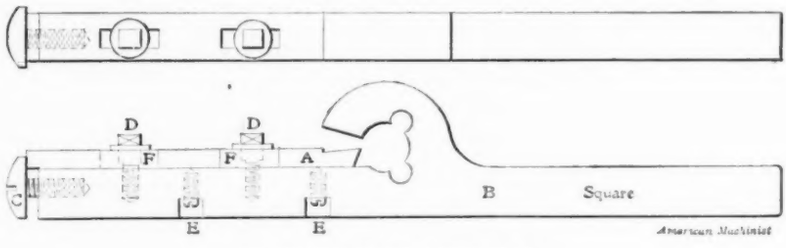
MARKING HOLES.

hand to get a smooth coating, all that was necessary was to transfer the holes by turning the piece once around in the hole. I got a very fine circle. HARRY ASH.

A Set of Milling and Drilling Fixtures.

Editor American Machinist:

The sketches show three fixtures for machining Fig. 1. The base *a* is faced, also both sides of *b* and the outer end of hub *c*, the holes drilled as shown, those through the lugs to be in line and parallel with hole through *b*. Fixture Fig. 2 is for milling the base, the work being shown in place. The surface to be milled faces the machine spindle, and an end mill does the work. Wherever an end mill can be used to do surfacing it is very efficient. A very coarse feed can be used and still produce work that is practically true. Screw *a* is



ADJUSTABLE HAND SCREW-PLATE.

adjustable to give the right tilt to the work; *b* is a clamp to hold it in place against the fixture casting. Screws *c c* also help to locate the casting and hold it to do the cutting. If the castings came uniform enough, one of these could be locked with a check nut.

The second operation is the drilling, which is done in the jig, Fig. 3. *A* is the casting of the jig, and *B* the clamp which

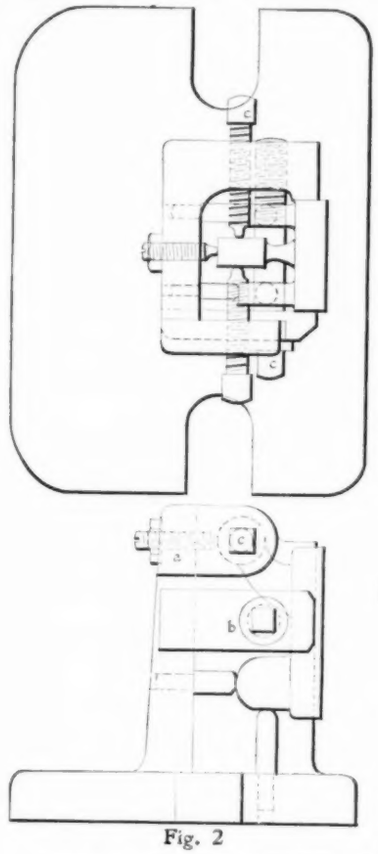


Fig. 2

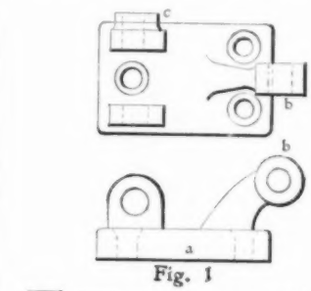


Fig. 1

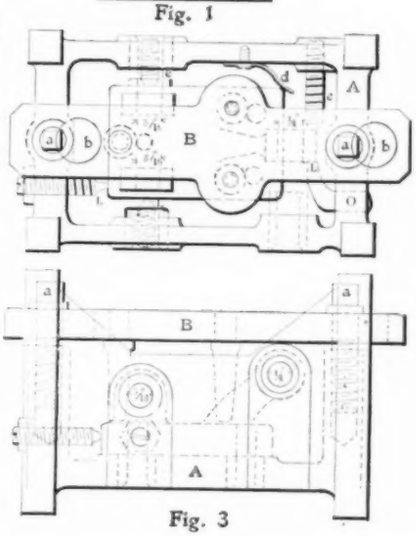


Fig. 3

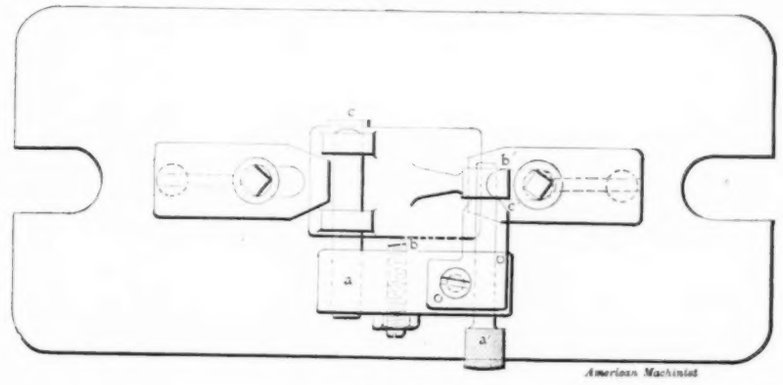


Fig. 4

A SET OF MILLING AND DRILLING FIXTURES.

secures the work in place. *B* has three legs that bear on the work in the jig, and by tightening screws *a a* it is clamped in position. To remove the clamp to take the work out, the screws are loosened and the clamp is pushed to the left to the limit of holes *b b*, which are larger than the screw heads, when it can be lifted out of the way. In putting the work into the jig it is held against gage points *c c c* by spring *d*, while the clamp is put in place and tightened, then the screws *c c* are tightened to take the thrust of the drill. The holes through the lugs and projection *b* are reamed, using a spotting drill, reamer drill and rose reamer. The three countersunk holes are only drilled.

The next step was to mill the two sides of *b* and the end of hub *c*, in Fig. 1, which was done in fixture, Fig. 4, requiring two operations or settings of the work. In both of these the work was located by pins *a a'* and held by the two clamps shown. *b b* is straddle-milled. In this operation the work was gaged against the screw *b*, and after it was secure pin *a'* was removed from the hole; this cut finished, screw *b* was removed and gage-plate *c* was put on with dowel-pins and screw to gage from the surface just milled and a cut taken at *c* with an end mill. These fixtures are all quite simple and not very expensive, and facilitate greatly the production of these parts. NAC.

A Job on the Shaper—A Correction.

In my letter on page 1250, headed "A Job on the Shaper," occurs the following statement: "He would first place on a parallel as many pieces as the shaper vise would easily open to," etc. This would naturally lead to the impression that the pieces to be shaped were laid side by side and that the tool went over several of them at the same stroke. This, however, is not the case, as the pieces were all laid in end to end, and the tool cut each one separately. ROBT. A. LACHMANN.

Bench Fitting for Incandescent Electric Lamps.

Editor American Machinist:

It is sometimes a difficult matter to decide on the best arrangement for carrying incandescent electric lamps over fitters' benches, and on the machines in an engineer's shop.

Some arrangement or fitting is required on which the lamp can be carried or suspended in such a way that the light can be easily and readily adjusted to suit the job in hand, and as readily swung or pushed up out of the way as occasion demands. It must be durable and able to stand the rough usage it is liable to get and at the same time be simple, not liable to get out of order and cheaply made. The sketch Fig. 1 shows the fitting which we have adopted in our shop, and it is one in which simplicity, durability and convenience are the points of interest.

Referring to Fig. 1, *A* is a rod 18 inches long, made from ½-inch gas tubing and supported by the two small brackets *B* and *C*, which are pieces cut and bent from 1¼x⅜-inch bar. *B* is drilled and tapped ½ inch gas thread and the end of the rod is screwed into it, while the hole in *C* is drilled to suit the outside diameter of *A*. The swinging arm *D* is about 2 feet long, or some other length to suit the circumstances, and is made from ¼-inch gas tubing. One end is tightly screwed into Tee piece *E* and the other end *G* is plugged. E is an ordinary standard Tee having the threads drilled out and the hole opened out to permit of its sliding freely and easily on rod *A*, and it is not fastened to *A* in any way, but is slipped over its end before bracket *C* is screwed to the wooden back.

The weight of the arm with the lamp, etc., is sufficient to nip the Tee on the rod at any desired hight with no fear of the arm slipping down, the action being shown in Fig. 2. By slightly raising the point *G* the arm can easily be moved up or down the rod A, and when let go it at once fastens itself.

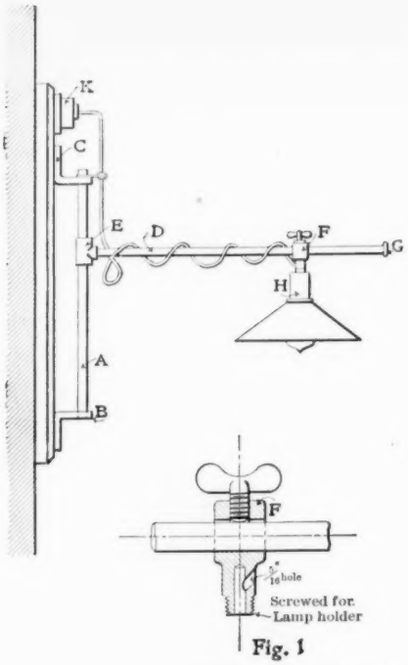


Fig. 1

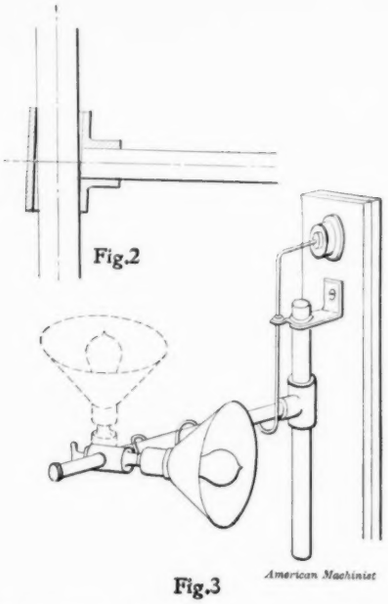


Fig.2 Fig.3

BENCH FITTINGS FOR INCANDESCENT LAMPS.

The lamp is attached to the lamp carrier *F*, shown in detail in Fig. 1, and turned in quantity on turret lathe from 1-inch rod. The hole in the side is drilled large enough to permit of its being slipped along arm easily, and a thumb-nut is provided to secure it to arm *D*, while the bottom end is screwed to fit the hole in top of switch lamp holder *H*.

This enables the lamp to be adjusted to any position along arm *D*, and also to be fixed at any angle about *D*, as shown in sketch Fig. 3, while arm can be raised or lowered on rod *A*, and at the same time swung a complete semi-circle about *A*. The brackets *B* and *C* are screwed to a wooden back, which also carries an ordinary 2¼-inch ceiling rose *K*, and the fitting is complete to fasten to the wall.

This fitting may not be new to many of your readers, still some may not have run across it. We find it very serviceable, there being no universal joints with internal wires, nor balance weights and small pulleys to get out of order.

C. PATTERSON.

Warrington, England.

A Small Piece of Work and the Fixtures for it.

Editor American Machinist:

Fig. 1 shows a piece to be machined and the others show the tools. The first operation was milling the surfaces marked *f*, for which the vise jaws Fig. 2 were made. The jaw marked *A* was formed to grip the work at *a* and *a'*, and jaw *B* was fitted with a swiveled block *b* to allow for inequalities in the work. It was so made that in gripping work it would back against the solid jaw at *b'*. There was fastened to *A*, resting on the bottom of the vise, a block with three vertical pins with rounded tops for the work to rest on. Two cutters were used, doing the work at one cut, one cutter being 3/8 inch larger in diameter than its mate, to give the difference in hight. The jaws were machinery steel, case-hardened.

The next operation was the drilling, for which the jig, Fig. 3, was used. This is the common latch jig, adapted to a great variety of work. The seats upon which the work rests are machined to correspond with the different hights of the bosses in the piece to be drilled. The work is put into the jig and the clamp and lever are pushed down and locked, the pin *e* and lever *a'* being fitted to make it clamp as desired. *b* is made to rock both ways to adjust itself to the casting. The spring shown on the under side of the clamp locates the work by pushing it against gage points *c* and *c'*. The two screw holes in the piece are drilled through the bushings *d d*. The other three holes are reamed, first using a spotting drill then reamer drill and rose reamer. Seven spindles on a multiple spindle drill were required for all these operations. The main part of the jig was cast iron, the spring and bushings tool steel and the rest machinery steel, case-hardened.

The next and last operation was the tapping, for which an ordinary angle-iron, Fig. 4, with four pins was used, the piece being reversed for the two holes, care being taken that the center pins did not project far enough for the tap to strike them. The face of the angle-iron was fitted with two blocks *a a*, 3-16 inch high, to make the work set true. The work was held on with the hands, and the holes were tapped in an upright tapping machine. I have worked in shops where there was no tapping device of any kind, except those that were paid by the day and left the shop at night, when, as a matter of fact, there is hardly a machine that will save its cost quicker than one for tapping. The three reamed holes in this piece of work were required to be quite accurately located, there being only .001 inch limit allowed either way on each hole. A man who could safely carry the job through without special tools must be an experienced workman, while with the tools a man with much less experience could do the work, and the finished job would be more uniform and the holes would be well within the limit. In machining from 500 to 700 of these simple parts with the tools enough can be saved over the other way to pay for the tools, and with a larger number of pieces there should be quite a margin in favor of the fixtures. M. A. C.

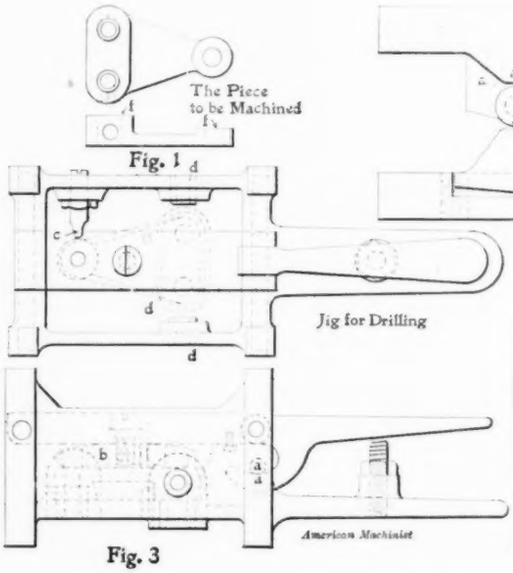


Fig. 3

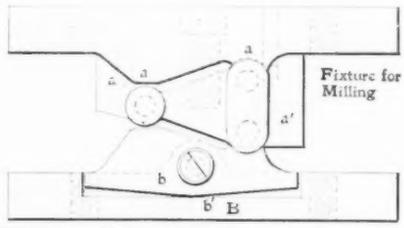


Fig. 2

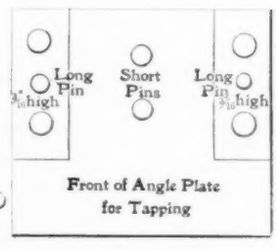


Fig. 4

FIXTURES FOR A SMALL PIECE OF WORK.

Some Tools for Planer, Lathe or Slotter.

Editor American Machinist:

Lately, wandering into a large general repair shop, and noticing there the wonderful tool equipment of planer, prompted me to send in this about tool-holders. Lying around one planer were over a hundred tools of divers forms, each made to catch some odd job on the fly. About thirty of these tools were for reaching into hubs or narrow places. There were tools for removing stock and then square-nose tools for cutting slots of different widths. It is strange to me that those who had such work to do could not have thought of the tool-holder shown in sketch, Fig. 1, a tool that would have been superior in several ways, saving both time and good tool steel.

Here are some good tool-holders that are money-makers. In Fig. 2 is shown a tool-block for the planer. The oblique transverse slot *a* could carry a broad-nose finishing tool. This is shown also in Fig. 3, and Fig. 4 is a further adaptation of the idea in a tool-block of a greater reach carrying side cutting tools. Fig. 5 is a parting tool or square-nose tool-holder, a most rigid tool for deep parting. Square-nose tools of different width could be used in this holder.

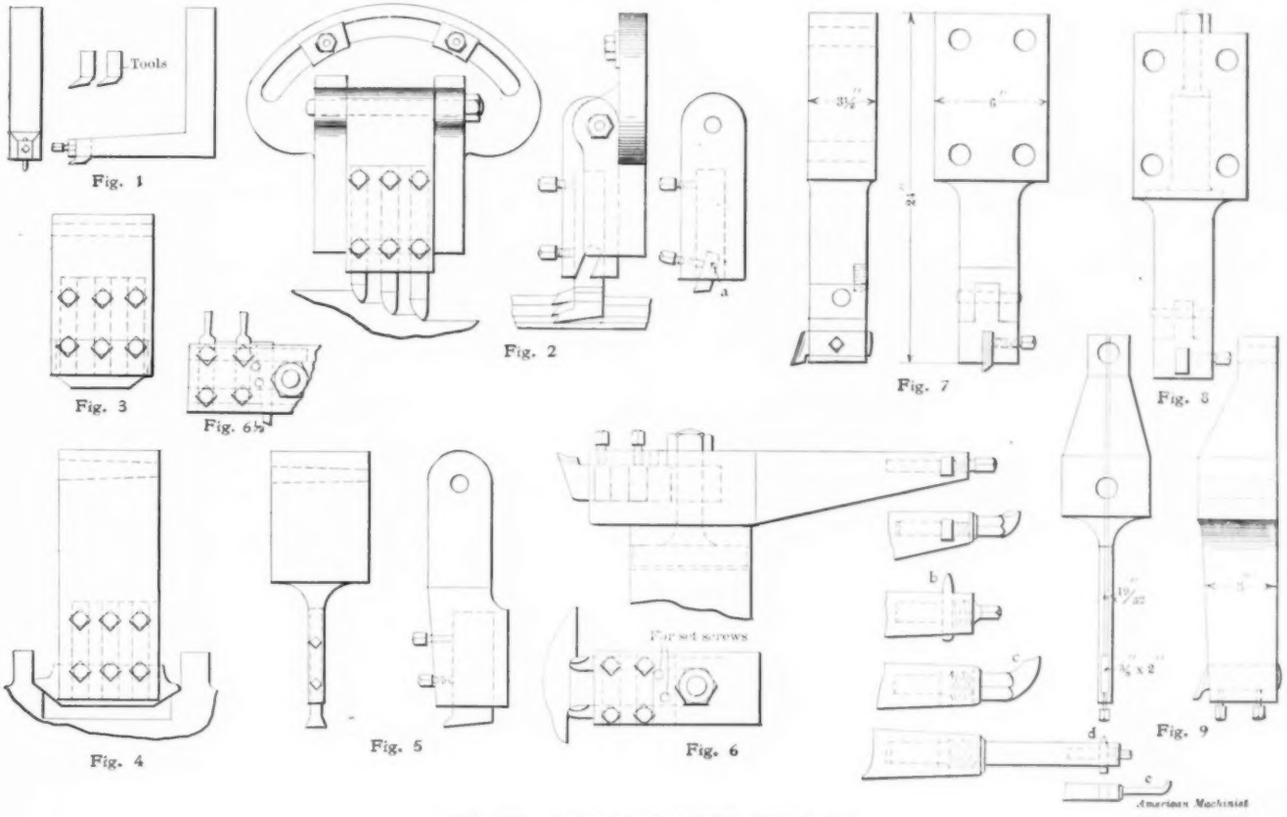
Fig. 6 is a fine tool-holder for the lathe —a duplex, holding tools either endways or crossways. The slot holding parting tool *a*, Fig. 6½, could be wider than the other, and the tool could be keyed sideways; the noses of the parting tools are thus made adjustable to a plug or gage.

In the other end of the holder is a boring tool of a very good type. At *b* is a cutter for boring straight through. Removing tool *b* and the set-screw, the boring tool *c* can be screwed in, making a fine bottoming tool. At *d* is shown an extension of the boring tool, and at *e* is a further extension.

Knowing that many machinists think a relieving tool necessary for the slotter, Fig. 7 is shown. For the benefit of the gentleman who submitted the design of a slotter tool-post on page 1112, it is here suggested that this tool-post, made to the dimensions given, would be suitable for his 16-inch slotter.

Fig. 8 is a slotter tool-post that can be adjusted for relief to all points of the compass. Fig. 9 is a parting tool-holder for the slotter; a 19-32 inch blade, in which square-nose tools from ⅝ inch up could be used.

FRANK RATTEK.



SOME TOOLS FOR PLANER, LATHE AND SHAPER.

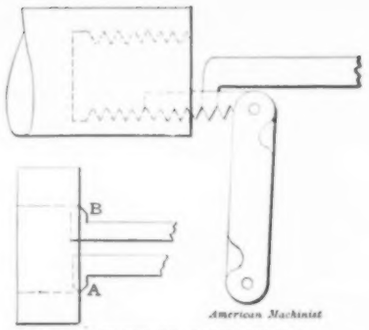
Two Screw-Cutting Suggestions.

Editor American Machinist:

Probably no operations in machine-shop practice have been more discussed than those connected with screw cutting, yet the subject is by no means exhausted, and I offer the two following hints: It is more or less of a bother to have to reset a tool, even with a compound rest, when the thread is nearly finished. This is especially so when the hole is small so that it is difficult to see how the tool is cutting. I use a pitch gage, as shown in the sketch. Of course, all lost motion must first be taken up by turning the lathe ahead a little.

In cutting a left-hand internal thread, by using a tool with the cutting point turned the other way and running the lathe backwards, a left-hand thread can be cut with the carriage feeding toward the head-stock and with a better view of the work than when cutting right hand. Instead of the cutting point being at *A* it is at *B*. In working without backing, by unlocking the nut and moving the carriage back, you can see before the tool strikes the work whether you have made a mistake or not. My experience is that even a careful workman occasionally fails to move the carriage back just right, and if he cannot see the tool enter the work he has no warning until some damage is done.

ENGINE LATHE.



SCREW-CUTTING SUGGESTIONS.

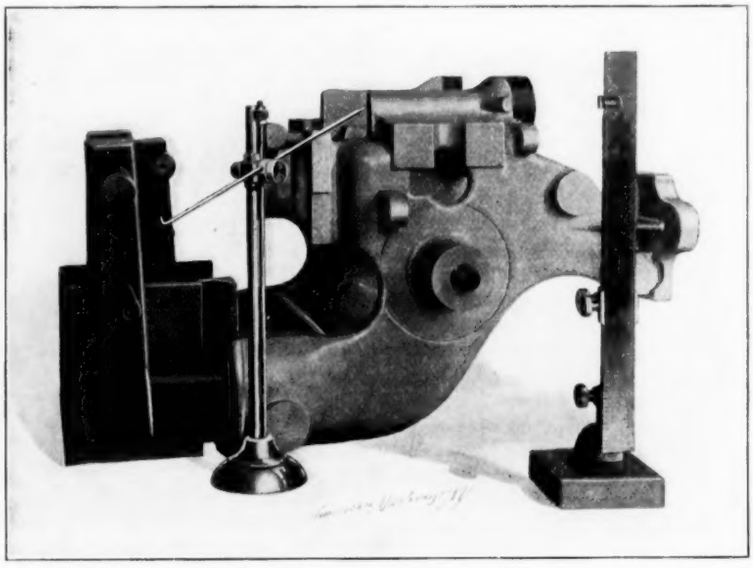
Inspection of Pattern Work.

Editor American Machinist:

Having read the article on "Inspection of Patterns," by John M. Richardson, page 1057, and how he manages to hold his rule with his block of wood with a slot in it, I am tempted to show him and other craftsmen something I have made. The picture shows a pattern clamped by hand-screws to an angle-iron, with also a surface gage and my adjustable rule holder. The angle-iron has three sides to it, with a "V" planed in one of them. With this kind of an angle-iron you can clamp a pattern to one side of it and then tip it up two ways to measure it without changing the clamps. This is working on the same lines as the machinist, and your work may be laid out both ways with the surface gage. First locate the center of the boss, or some other suitable starting point, and then adjust the scale for hight, so that the surface gage will register on some inch mark on the scale and place the spring clip over that mark, so that you cannot make a mistake when glancing at your rule in a hurry, as you often do while measuring a pattern during a rush, or while being called to the telephone or interrupted by some one wanting information. This clip has a slot in it, so that the inch line on the rule shows plainly. Begin the measuring from this inch line, and you can scribe off all the center lines both ways by turning the angle-iron to which the pattern is clamped, never being bothered with the finish left on the pattern, as that will show of itself. In a good many cases there are core prints on the bottom of a pattern, as there are in the one here shown, and in that case the rule is raised the hight of the finish allowed, and then it is plain sailing all through the pattern.

I use a 1-foot shrink scale for small work and a 2-foot for larger work. Anyone having many patterns and jigs to inspect will readily see the advantage of this rule holder and spring clip. Take, for instance, a box jig 24 inches square with a number of bosses and steps on it. Place the clip on the rule at the hight of the center line of the jig and you can slide the rule holder around your pattern and see at a glance if things look right above or below the clip. It saves an endless amount of time and trouble when measuring a pattern by always starting to measure from the even inch, not being bothered with odd thousandths or sixty-fourths all through your pattern. How many times a foreman is interrupted while inspecting a pattern; and yet it is his duty to detect all errors made by his men, and I find this system of measuring practically eliminates the chances of making mistake. The "V" planed in the angle-iron is used for clamping small round work.

Since the picture was taken I have added a bracket or swinging arm to the scale holder to hold a card of decimal equivalents, which I find very handy, as all our drawings are figured in thousandths of an inch. I find this scale holder the slickest thing I ever measured a pattern with.



ARRANGEMENTS FOR PATTERN INSPECTION.

GEO. H. GLIDDEN.

Winchester, Mass.

Prairie Engineering.

Editor American Machinist:

I wish the readers of the "American Machinist" would give their experience in repairing gas or gasoline engines. There are a good many of these engines scattered over the country now. I had a little experience a short time ago that might be of use to someone else. The firm had sold a portable gasoline engine that had given entire satisfaction for some time. One day the firm got a telegram to "send man immediately; engine won't go." This engine has a tank in the base to hold the gasoline, which is pumped up to carburetter, the overflow running back to the tank. When I reached the engine I found it standing on a slight incline, the end of the tank where the suction is being lowest. I examined the sparker, battery and valves; everything seemed to be all right. The man in charge told me he never saw an engine work better than that one had until they pulled up to that place, and since then he had been unable to get it to fire. I tried it several times, with the same result. I then opened the carburetter to see if the gasoline valve was working. As soon as I saw the fluid running I "tumbled to the racket." The pump was pumping water instead of gasoline. The tank being on an incline, the water, which had gotten into the tank by some mysterious means, settled in the lowest part of the tank, covering the end of the suction, the return keeping up the supply of water. We drew off the water and put in a fresh supply of gasoline, and that engine is still giving entire satisfaction.

When we go out on a job in this country we don't have mountains to climb, as Mr. Osborn does in the Oil Country, but we do sometimes have muddy roads that are a terror. Some years ago I was sent out to a slaughter-house about three miles from the shop, to put some repairs on the steam rendering tank. I left the blow-off cock open when I came away. The old cock had a flat head with a hole through it to put a pin in to turn it by; the new one had a square head. The next day we got a message to "come fix the tank right away; the man has not done his work right." I took a pair of pipe tongs and a monkey-wrench and walked that three miles through the mud. When I got there I found the engineer (?) standing near the tank and steam blowing through that blow-off at a lively rate. It made so much noise I could not understand what was wanted, so I put on my wrench and shut the blow-off cock, then I went over to the engineer and politely asked him what he wanted. "Dot ish schoost vat I vanted. I vanted dot made shut."

W. A. BRIGHT.

Requests for Catalogs.

Editor American Machinist:

Articles under this heading in recent issues of your valuable paper influence me to write to say that I have had some experience in this line, and the reading of this may be interesting to some manufacturers who are a little "grouchy" about forwarding one of their little 6x9's, or whatever the size may be, as per request.

My object in the first place was to get these catalogs for the valuable reference tables some of them contained, and while not in a position at that time to either buy or recommend purchase, it has since come to pass that I am, and I have not forgotten those who cheerfully and promptly

filled a mild request that materially aided me in bettering my positon.

I frankly confess that, had I not been armed with the information which some of those catalogs contained, I would have had to seek the desired information from fellow-workmen; and every toolmaker, machinist and craftsman of any kind knows how much the man accomplishes who has to look to his shopmates for pointers.

Out of probably twenty-five requests I have received twenty catalogs in the past five years. Those I failed to hear from will of course never hear from me.

TOOL MAKER NO. B.

Foreign Shop Kinks.

Editor American Machinist:

I had the good fortune some time ago to visit a German shop, and one thing that struck me as especially interesting was the splining of a feed shaft for a lathe 28 meters (91) feet long. It was planed from the side with a special tool, as shown in Fig. 1. The shaft was several times the length of the planer platen, so it had to be reset three or four times; but with this arrangement they secured a cut the full length of the platen at a time.

In a well-known English shop I saw a new way (to me) of chucking cored holes in cast-iron pulleys, gears, etc. The tool used was simply a heavy flat drill, Fig. 3, supported on the back center of the lathe, and passed loosely through a slot in a special steady-rest close to the work, as shown in Fig. 2. A heavy weight was hung on the drill close to the rest, to keep it flat on the lower edge of the slot. The hole was finished to size with the tool, Fig. 4, and we were assured that the work was done at one half the cost of the usual method of boring and reaming in a turret lathe, and that the work was all that could be desired, both for smoothness and for accuracy of size.

P. A. G.

"Hypercriticism."

Editor American Machinist:

So it seems that the old rule to "speak only good of the dead" is now to be extended, according to the discourse of Mr. Tecumseh Swift, on page 1252, to apply also to recently patented inventions. I do not know whether there is in this any suggestion that the inventions referred to have "died a bornin'" or not. I am very much gratified that my remarks on page 1109 about the center punch patents did not slip by unnoticed, and in what has already appeared in consequence of what I said, I may claim to have my complete vindication. I find great pleasure and satisfaction in having called out by my "hypercritical" remarks the very neat and every way satisfactory little "spacing center punch" shown on page 1247. That, I suppose, everyone must concede is both theoretically and practically correct. The writer in describing it says that he saw for himself the disadvantages which I pointed out, and that on account of those evident disadvantages he devised the one shown by him. Now, if he had not seen the disadvantages, and if had not spoken of them, the readers of the "American Machinist" would have missed the little center spacer, which would have been a distinct and appreciable loss, while I can't imagine any counterbalancing advantage that could possibly have resulted from my silence. It is so every time. I believe implicitly in not only the right but the duty of fault-finding—where the faults do actually exist. No improvement can ever be expected to follow the constantly reiterated assurances of the professional optimist that anything or everything is just as right and satisfactory as it can be. I am just as much of an optimist as Mr. Tecumseh Swift is, but my optimism looks to the future rather than to the past or even the present. I believe that everything however good it is, may be better and will be better, and I propose to do what I can to help to make it so. A practical optimist is better than a theoretical one.

Having got to this point it would be not quite proper, while highly commending the little spacing center punch of Mr. C. Aliper, to let it slip by without a suggestion of simplification if not of positive improvement. Referring to the drawing on page 1247, I would like to ask what is the use of the spring and screw and the sliding movement of the short punch? As long as the other one moves freely up and down, why should the short one slide or move in the block at all? If to-day—I might do it differently to-morrow—I was going to make a little spacing center punch I would take and drill two parallel holes of the same size and the desired distance apart in the block, and then I would fit the short punch tight in one of the holes, driving or crowding it in from the under side up to a little shoulder and letting it stay there. Then with a nicely fitting but freely sliding punch in the other hole the instrument would be complete.

This talk about the spacing center punch, although the tool is a little one, and perhaps not of the highest importance, is still not unprofitable. I suppose it can hardly be doubted that some of those who have occasion to use such a tool will by and by be found to be using better tools for the purpose than they would if not a word had been said. This is only a suggestion of the effect of the more extended and long-continued discussions of large tools and machines and general methods that have been going on in the columns of the "American Machinist" ever since I have known it, with the result that the practice of every shop in the land has been vastly improved, its output has been increased and all its enterprises have been made surer and safer. I have confidence

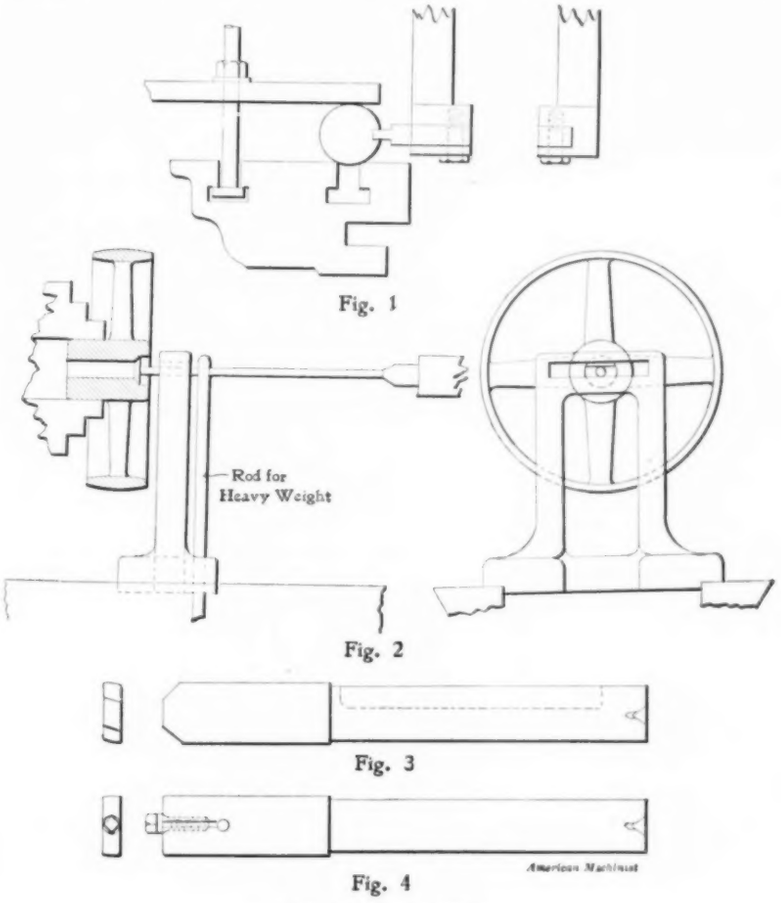


Fig. 1

Fig. 2

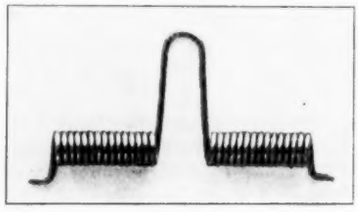
Fig. 3

Fig. 4

FOREIGN SHOP KINKS.

that such discussions will continue, with good results still following them. I understand perfectly that while the letters flow on so freely they do not flow without guidance and scrutiny, and that the stream of correspondence is so clear and smooth because extraneous matters and impertinences are caught by the editorial mesh and excluded.

It happened that in the case of the spacing center punch I led off with some remarks concerning a couple of recent patents for such tools. It really ought not to be necessary for me to offer any justification of my action. When a new patent issues for any device the most absurd thing, as it seems to me, is for the patentee to object to a free and full discussion of it. The patent distinctly challenges discussion, and no discussion can be either complete or final unless both sides have free expression. I certainly sympathize with the patentee, and I would most gladly help rather than hinder him, but I can't be expected to do either with my eyes shut. The discussion can never be in the interest of the patentee alone, but in that of his prospective customer also, and if I should happen to say something unfavorable concerning the patent I might still be earning the thanks of the public or of the individual purchaser. If I was mistaken in my views, the patentee still could not be permanently injured, because the American mechanical public is not to be fooled, and *ipse dixit* is not worth a cent. If I am charged with the atrocious crime of



THE WIRE AS BENT.

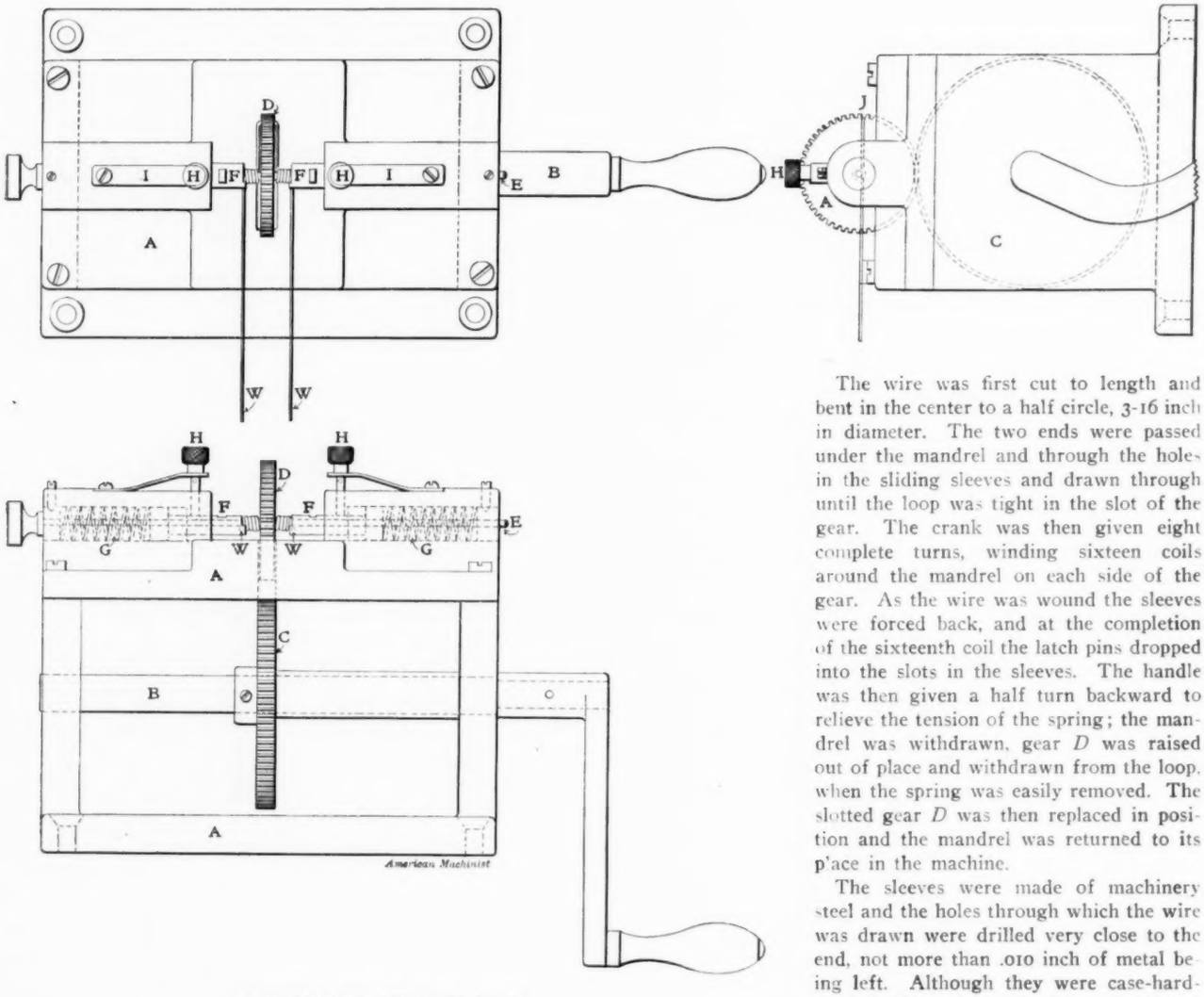
hypercriticism I think that still the patentee need not complain, for it must help to advertise and call attention to his pet, and if sufficient attention is commanded the intrinsic merits can be depended upon, provided they exist, to do the rest.

MORRIS FULTON.

A Special Wire Bending Device.

Editor American Machinist:

I suppose nearly everyone who runs a general machine shop and takes in everything that comes along, occasionally agrees to do something without thinking much of the method of doing it, and afterward finds that it is not so easy as it looked. The little spring sent herewith, Fig. 1. (shown full size), proved to be a job of that kind, and I puzzled some time before I hit on a way of making it. The difficulty arose from the fact that while the spring required to be wound on a mandrel .078 inch in diameter, the wire from which it was made was .040 inch. However, the slotted gear wheel and the sliding sleeves solved the problem and the job was fairly remunerative after all. In the drawing, Fig. 2, *A* is the frame; *B*, the driving shaft; *C*, the driving gear; *D*, the slotted gear that carries the wire around the mandrel; *E*, the mandrel; *F*, sliding sleeves with holes through which the wire is drawn; *G*, spiral springs; *H*, latch pins; *I*, latch pin springs; *J*, the slot in the gear, and *W*, the wire, which is shown with four coils wound.



A SPECIAL WIRE BENDING DEVICE.

The wire was first cut to length and bent in the center to a half circle, 3-16 inch in diameter. The two ends were passed under the mandrel and through the holes in the sliding sleeves and drawn through until the loop was tight in the slot of the gear. The crank was then given eight complete turns, winding sixteen coils around the mandrel on each side of the gear. As the wire was wound the sleeves were forced back, and at the completion of the sixteenth coil the latch pins dropped into the slots in the sleeves. The handle was then given a half turn backward to relieve the tension of the spring; the mandrel was withdrawn, gear *D* was raised out of place and withdrawn from the loop, when the spring was easily removed. The slotted gear *D* was then replaced in position and the mandrel was returned to its place in the machine.

The sleeves were made of machinery steel and the holes through which the wire was drawn were drilled very close to the end, not more than .010 inch of metal being left. Although they were case-hardened I did not expect they would last

long; but 6,000 springs were made and the holes show very little wear. The ends of the springs were cut and bent by a small die used in a foot press.

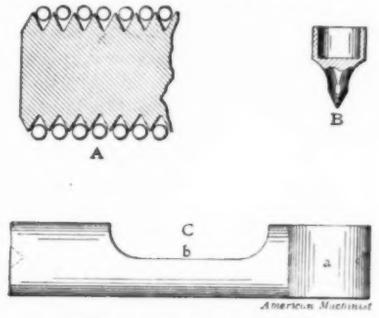
J. A. WEBSTER.

Chucking Screws — Micrometer Points for Calipering Screw Threads—Setting Lathe Tools for Hight.

Editor American Machinist:

I send you herewith sketches of several devices I have found extremely useful in everyday practice, trusting they may be new to some of your readers.

The first, *A*, is the kink of using a piece of soft wire, preferably brass, but, in the absence of that, annealed iron wire will do, coiled around a thread for protection while dogging a piece of work that is to be operated on in the lathe. Every machinist has had his temper ruffled by the dog slipping and either spoiling the thread or



THREE LITTLE SHOP KINKS.

flattening the top, so it was necessary to rechase or run a die over it. These experiences can be avoided by wrapping a wire around in the manner shown and dogging as though no thread were there. [The above suggested device is not new to our columns, but it is worth telling of again.—Ed.]

B shows a point to be used on a micrometer spindle to caliper a thread. In the absence of thread micrometers this answers very well in duplicating taps and similar work. The best way to make it is in a bench lathe, boring it to fit the spindle of the micrometer a close wringing fit with the fingers, driving on an arbor and holding in a spring chuck to rough out, then hardening and grinding the point with grinding attachment; but, as a great many shops are not equipped with bench lathes, it can be made in an engine lathe and ground with a center grinder.

C is a gage for setting a tool central in hight in the lathe, which is often quite necessary, as in chasing a tap, or in forming a circular cutter for the screw machine. To make this we take a piece of steel, possibly 4 inches long, center it and turn to ¾ or .750 inch. We then place the piece in the milling machine on the centers and mill the middle portion down one-half, or to .375 inch. We then index one-quarter around and flat off the side at *a* at right angles to first cut. To center a tool the gage is placed on the lathe centers, the flat *a* squared vertical and the tailstock center tightened. The thread tool or forming tool is then raised or lowered until the top just touches a straight-edge laid across at *b*.

W. E. CALLAGHAN.

Canton, Ohio.

Punching Four Holes at Right Angles.

Editor American Machinist:

The drawing shows a punch and die for piercing four holes at right angles to each other in the piece shown enlarged in Fig. 4.

J is the bed, which is milled away on the outside to make it handy to get at and to lay out and drill the holes for the pins *D* which fasten one end of each of the links *C*. The inside is bored to receive the pieces *A* and *B*, Fig. 1, and deep enough to give the motion required to carry the punches through the blank. The piece *A* is then milled out to receive the slides or punch-holders, which are fitted nicely to it, and all held in place by the plate *B*. The slides *K* are milled on the bottom to receive the links *C*, which are pinned to them by the pins *I*. They also are drilled as shown in the section for the punches *H*, held in their places by the screws *G*. The punches *H* also have support in the small holes in *A*, and never travel back far enough to come out. Fig. 3 shows a piece fitted to the plunger of the press, the end of which is turned down to an easy fit for the taper hole in the blank to be pierced, and just long enough to clear the punches as they come through.

The blank to be pierced is placed in the hole in the top of A, which is just deep enough to allow Fig. 3 to bear hardest on the plunger *A*. The plate *B* is fastened to *A* by the four screws *F* and is milled out to clear the links as the plunger comes up. When the blank is in place and ready to be pierced the press is brought down, which forces the plunger *A* down, also causing the slides *K* to travel forward until they have pierced the blank. The plunger is then brought back by the pin E, which is operated by a lever, not shown,

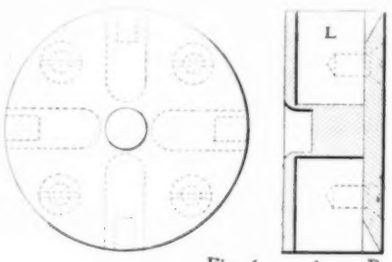


Fig. 1

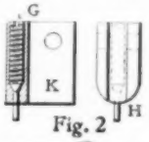
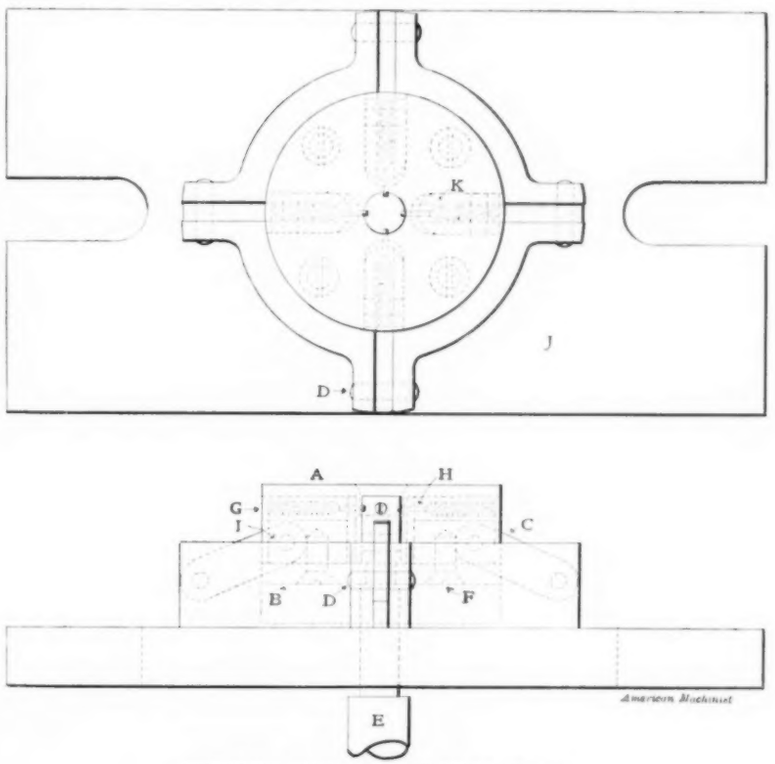


Fig. 2

Fig. 3

Fig. 4



PUNCHING FOUR HOLES AT RIGHT ANGLES.

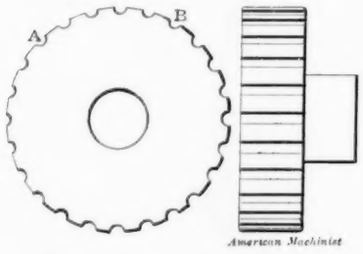
and which comes up with sufficient force so that when *E* strikes the bed *J* it will jar the blank out ready for the next. *E* goes up through the bed and is screwed into the plate B. This arrangement is a little different from most of the dies used for this purpose; it is very easy working and easily repaired. M. W. LEECH.

A Time Saving Milling Operation.

Editor American Machinist:

The shop had made a good many hundred knurls like those shown in the cut, when one day I picked one up to examine it. It was nicely turned all over and the grooves were milled, after which the polishing department put a good finish on it. Of course the milling had been done by stringing half a dozen on an arbor and running the cut through the lot, indexing twenty-four times to complete the job.

Now, I didn't expect to find anything wrong with that knurl when I picked it up; but I did expect to find a better way to make it, so I held it up to the light to see how many grooves could be milled at once. If the reader will examine the cut



A TIME-SAVING MILLING OPERATION.

he will find that the letters *A* and *B* are at the limits of a set of six grooves which can be produced simultaneously without under-cutting.

The foreman of the milling room (who, by the way is one of the most valued contributors of the "American Machinist") disagreed with me as to the feasibility of the scheme of doing the job with four indexings instead of twenty-four; but in spite of his doubts I went to the toolroom and had a gang of six mills made, with the necessary washers for spacing them properly. The results fully justified my belief in the method and helped to relieve an overcrowded milling department to the extent of 75 per cent. of the time on that particular job. L. O. DANSE.

Detroit, Mich.

A Boring Jig.

Editor American Machinist:

In Fig. 2 is shown a jig for chucking the piece, Fig. 1, for boring the hole *L*, the requirements being that the hole must be true and central with the holes *T T*, already bored, also with the face *M* of the casting and equidistant from the ends. There were a number of different sizes, so that the jig was made adjustable longitudinally, with conical centers to accommodate the different size holes.

The base *O* is made of cast iron, the under side is faced, and in the center a slight boss *J* is turned to fit a corresponding recess in the face-plate of the lathe or vertical boring mill. The top is then planed, being in the form of the ordinary guide. The screw *G* is of machinery steel, one end having a square right-hand thread, the other a left-hand.

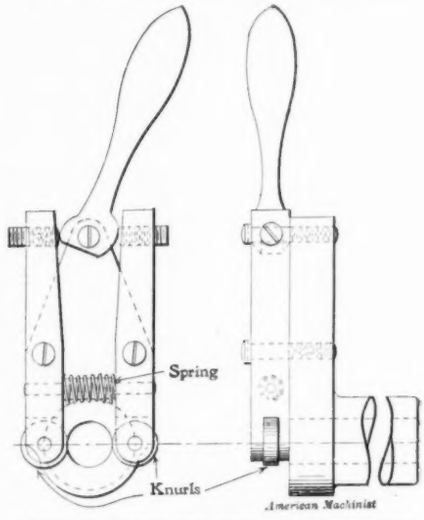
The ends of the screw are squared to receive a socket wrench to operate the screw, as shown at *H*. The length between the collars must be the same as the bearing *P*. The collars should be made generously large. The slides *R R* are planed and then threaded to receive the screw *G*. The screw and slides are placed in position on the base *O*, the slides are tightened by the adjusting screws *Q*, and then drawn toward each other to take up the lost motion, if there is any; after which the holes *N N* are bored and reamed. The centers *E E* are made, preferably of tool steel, hardened, ground and then forced into the holes *N N*. The adjusting screws *F F* are for truing the face *M* of the casting and also for holding it rigid during the boring. The lugs *K* are for fastening the jig to the face-plate or table, and can be modified to suit the conditions. S. B. MCQUADE.

A Knurling Tool for the Screw Machine.

Editor American Machinist:

Enclosed find drawing of a turret knurling tool, which explains itself. Those having experience with work projecting far out from the chuck will note its merits.

"MONITOR."

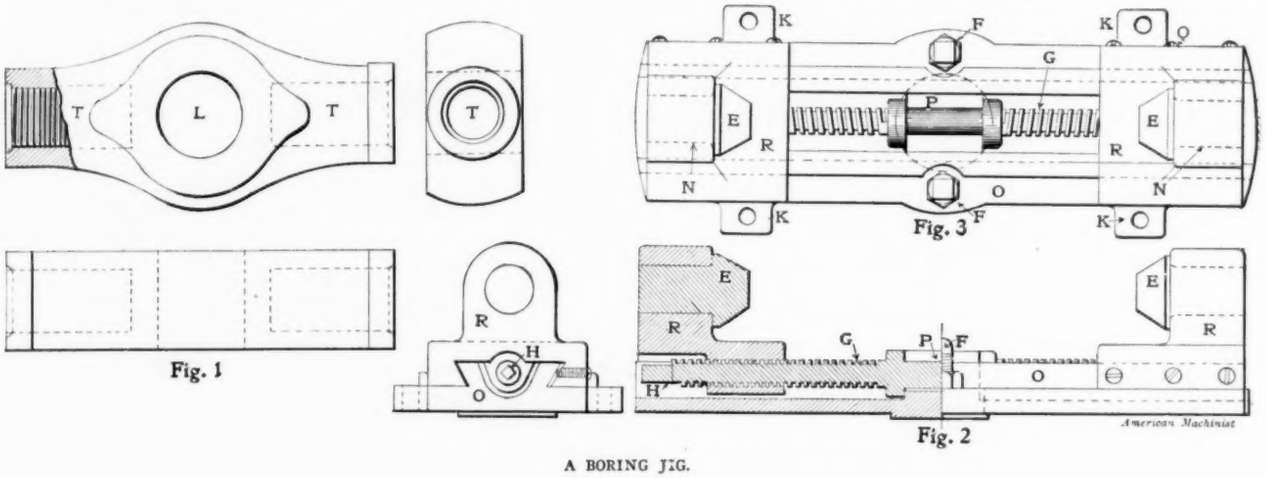


A KNURLING TOOL FOR THE SCREW MACHINE.

The Value of Shop Scrap.

Editor American Machinist:

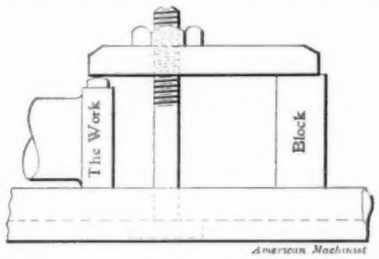
I was interested in what Mr. J. J. Hagelgren had to say on page 1253 about utilizing scrap, broken twist drills, etc. No doubt scrap is a necessity in a machine shop. I mean by that, not so much a large heap of it common to everyone about the place, although that is handy, as the odds and ends that accumulate around a workman's bench. These pieces of scrap, screws, etc., which a machinist will collect will come to have a distinct individuality to him. From a box of such material, when rigging up for a job, he will come to say instinctively to himself, "such a piece I can use here, and this screw there," and he knows right where to find them, provided of course some shopmate has not been on the hunt and taken part of them. But the most valuable part of such a col-



A BORING JIG.

lection has usually been taken care of. Now, this same combination would not have the same meaning to a man across the shop, and if it was given to him the chances are that all but a few likely looking pieces would be thrown away as worthless, and yet they have materially helped the one who collected them to do his work.

I well remember one stock-taking time, on coming back to work, to find that everything in the nature of scrap had been spirited away, and how for days and weeks



LOCATING THE BEARING OF THE STRAP.

it seemed that almost everything I wanted to use was some of that miscellaneous assortment of material that had been taken away in the interests of economy, and to replace it with stock that could be used on occasion meant many a trip across the shop and down flights of stairs to the blacksmith's shop and stock room, and what was true of me was true, to a greater or less extent, of every man in the shop, and it would at least be interesting if it could be known how much the taking of that scrap cost.

I keep some broken twist drills, and, while I shall remember Mr. Hagelgren's use for them, I have ground them down thin at the point and used them for starting holes; they, being thin and short, were not as likely to run, making this use of them on an occasional hole that was wanted pretty good and was not quite important enough to indicate true.

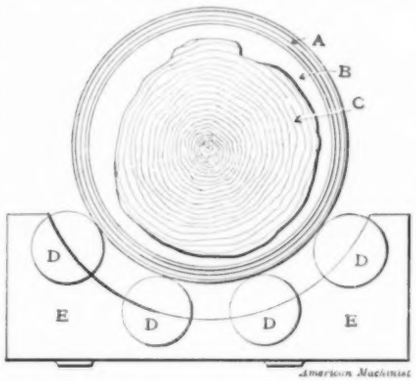
Another convenience about the shop is a box put in some place out of the way and filled with hardwood blocks of different lengths and sizes to be used as blocking. It would save many a trip to and wait in the carpenter's shop. In connection with these blocks good straps and bolts are very desirable; straps that are planed of assorted sizes, with good slots in them; bolts that are turned and their heads made to fit loosely in the slots of the different platens around the room; and then straps, bolts and nuts well case-hardened. These cost considerably more than the kind usually found about a shop, but they are always ready for use, and out of a dozen bolts the thread will not be stripped on six, and the nuts on the other six be so tight that time will have to be lost fixing them.

This leads naturally to just a word about the use of these straps and bolts. If the work is light, as a small jig, and the strap does not come on to the work flat, it will quite likely spring it; but by fastening a few thin pieces cut from a rod of brass with one side slightly rounded (see sketch) to go between the work and the strap, it brings the bearing where it is wanted. W. A. C.

A Way to Turn the Granite Columns.

Editor American Machinist:

I have read several letters on "Wasted Labor," and I do not wish to criticise any previous remarks, but I think that if it fell to my lot to do a job like turning those columns for the Cathedral of St. John the Divine I would like the idea I have tried to express by the sketch. Let *E* represent a carriage placed on the lathe bed with rollers *D*. *A* is a steel tire or ring put together in halves. Let *C* represent the stone to be turned. When all is centered exact, fill in the space *B* between the marble and the tire with cement that will harden and hold the column. Two of these rings and bearings might be used at a time, and if they were made of sufficient width would hold the weight successfully until the unexposed part of the column



A WAY TO TURN THE COLUMNS.

was turned. Then put under wooden shoes, take off the rings or tires and finish the space they covered.

JAMES G. NOAKES.

A Surface Gage as a Lathe Indicator —Feeds and Cuts.

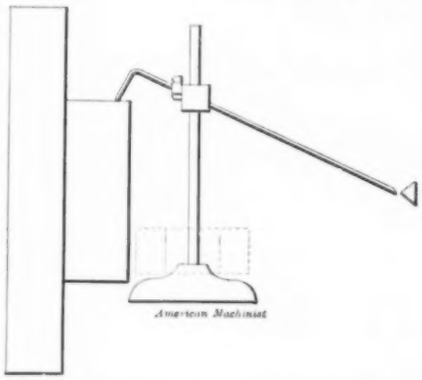
Editor American Machinist:

A short time ago one of your correspondents told how he uses a surface gage in chucking work in the lathe. An indicator can often be improvised out of an ordinary surface gage which, while only a substitute for the genuine article, nevertheless conforms to the fundamental principle of all indicators in that it magnifies the error.

The surface gage is placed on the carriage in the line of centers. The needle is loosely clamped, so as to move about the nut as a center, and a weight (a small nut will do) is hung on the short arm to secure its contact with the work at all times. It is convenient to bring the other end of the needle about to the tailstock center. The surface gage may be held securely enough by slipping a heavy collar over the stem on the base, as shown in the sketch by the dotted lines.

. . . . . .

I believe that the question of feed *versus* depth of cut should be given more attention by most lathe hands. All roughing cuts represent a compromise. A very heavy cut means a comparatively light



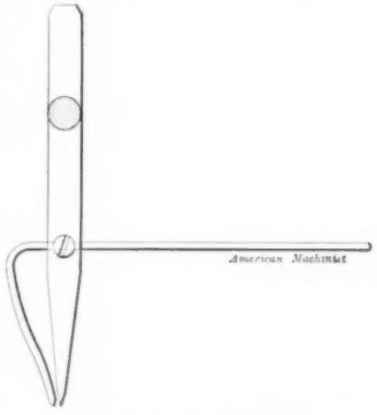
A SURFACE GAGE AS A LATHE INDICATOR.

feed, and a fast feed means a light cut. But it is by no means always as broad as it is long. On small lathes—say, 18 to 24 inches—I believe most mechanics will take a heavy cut and a moderate feed, and then point to the fact that the belt will pull no more, as an evidence that they are removing all the stock as rapidly as possible. My own experience leads me to adopt the other alternative. I find that three cuts with a coarse feed will often remove a given amount of stock quicker than a heavy cut with a moderate feed, and I find also that the centers in the work will not be so deformed by adopting this plan, so that the condition of the work will be more favorable for finishing. Z. Y. X.

A Spacing Center-Punch.

Editor American Machinist:

Here is another center spacer which beats anything for cheapness and usefulness. I find it very handy in working off holes to be drilled around some irregular shape to be cut out. I do not know of anything else that it could be good for where great accuracy is required; it takes about



A SPACING CENTER PUNCH.

an hour to make. In spacing off holes, you tap the punch very lightly and finish the marks with a solid punch. S. EESTOO.

One Method of Truing Up a Crank Pin in Place.

Editor American Machinist:

The pin was 4 inches diameter by 4½ inches long, and had seen better days, being badly scored and out of round. The collar on the outer end of the pin gave evidence of the warm times it had been through by its blue color verging on black. There were all the signs of an overloaded engine, and it was one that must run for a week, when once started, unless it absolutely broke down.

Repair time came, and it was a case of new brass, and perhaps a new pin. The calipers showed that 1-16 inch would true it up, and this was decided upon, as the facilities for forcing in a new pin were limited. The shaft was found to be level, and, with this as a starting point, a flat was filed the whole length of the pin, just enough being taken off to get below the scores and to bring it level. The first spot was filed with the crank pin on the top quarter, when the shaft was given one-half a revolution and a spot opposite the first one was filed, the calipers being used this time to bring the two flats parallel. The two remaining quarters of the pin were treated in a similar manner, and brought to the same diameter.

Next, a piece of scrap iron was bored the right diameter and cut in two, or about ⅛ inch off center, and the smaller piece used as a filing gage. Four hours' filing with bastard and then a smooth file, using a light coating of red lead on the gage as a marker, gave a very even spotting, showing the pin to be both parallel and round.

The final finish was put on with an outside lap, made from 2-inch oak plank, about as shown in the sketch. This was carefully fitted to the pin, and medium emery cloth tacked in. One end was clamped solid and all adjustments made on the other bolt. The emery cloth was changed once. The lap was turned by means of a piece of ⅝-inch round iron, driven in near one end. As the lap was turned on the pin, it was worked slowly back and forth from end to end. We used plenty of oil at this time. The cloth was pretty smooth at the end of an hour's work, and the pin—well, it had the dead, glassy lustre that a good crank pin should have, and since the engine started it has run perfectly cool, a proof that it is in good shape.

Some of your readers may ask why the pin was not squared from the face of the disk instead of being leveled. The reason was that we found the crank face out of true.

The time for this job, which included the making of the lap and gage, was 9½ hours. E. L. MILLS.

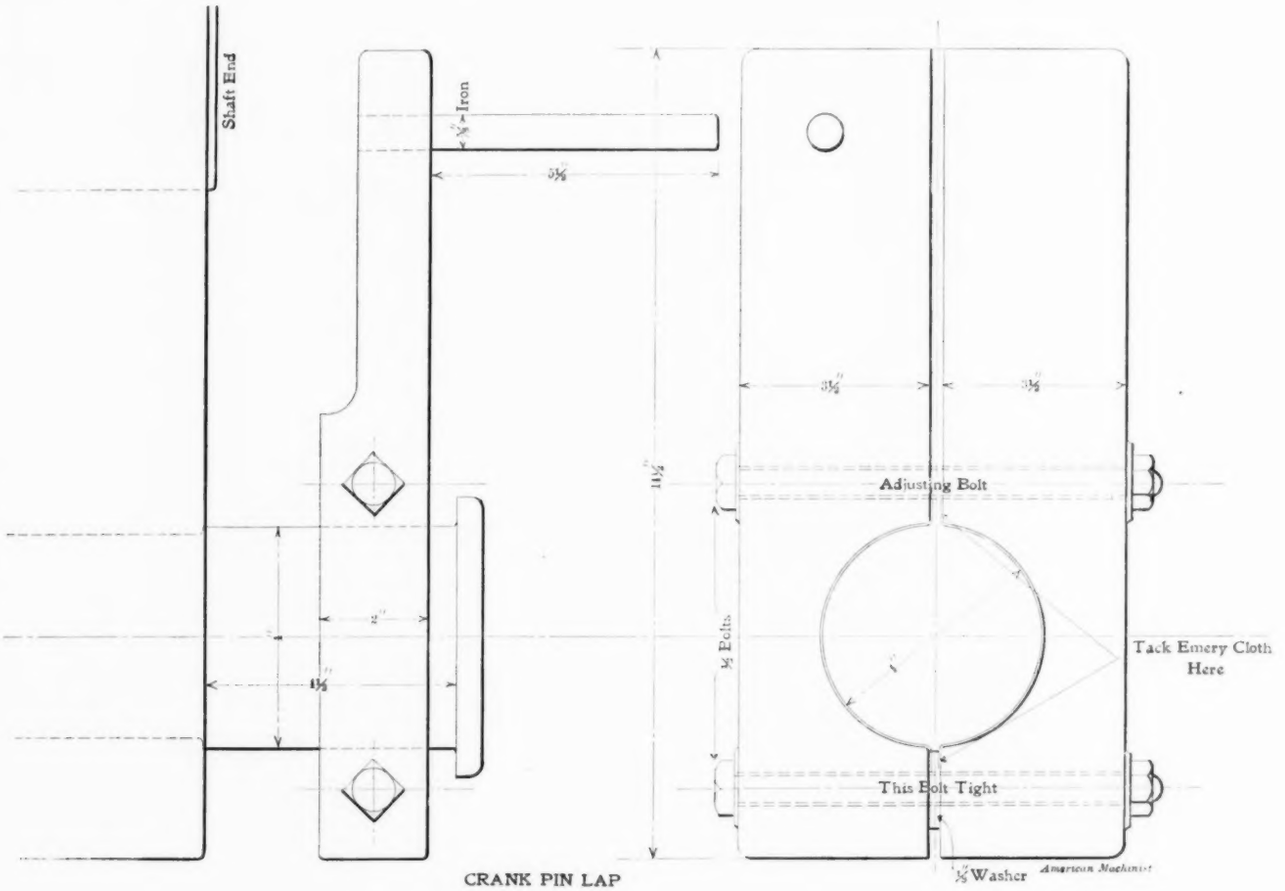
The Spacing Punch — A Cheap Lathe Indicator—Milling Calipers—Facing Nuts—Glass for Matching Templets.

Editor American Machinist:

I want to say a word in defense of the spacing prick punch condemned by Mr. Morris Fulton on page 1110. Theoretically, it may not work, but practically it fills the bill. I have used one a number of years, and find it a great time saver in the laying out of holes when I want to remove irregular pieces of metal by drilling. After drilling the holes, I take a broach that has plenty of clearance and remove the little metal that remains between the holes and the piece drops out.

There are also a few other useful tools which are easily made, but not on the market. The apprentice, or any other, not having a center indicator will find the following rig answers the purpose: Take a piece of drill rod, center one end and point the other. Place the center on the tailstock center of the lathe, and the point in the prick punch in the usual way, thus making of the rod a test bar. Now, take a piece of wire, about 1-16 inch and bend a loop in one end. Place this loop on the test bar near the work, and balance the wire on the notch in the diamond point lathe tool set parallel to the test bar. Test the work as with the ordinary indicator.

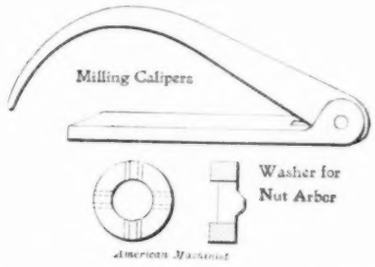
A very handy tool for the milling ma-



CRANK PIN LAP

chine is a milling caliper which is made the same as a key-hole caliper, with the exception that the straight leg is made ½ inch wide and shorter than the curved leg. It is used to measure from the cutter to the work.

We have all had trouble in squaring up nuts, when they fit the arbor loosely, by



the shoulder of the nut arbor throwing them out of true. The little rocker washer here shown allows the thread of the arbor to center the nuts.

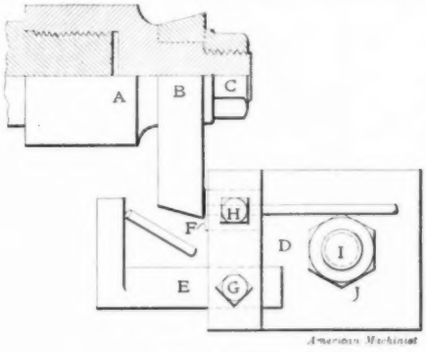
In filing up thin templets, a piece of glass will be found helpful in testing them. Lay them together on the glass when holding them to the light, and you will have no trouble in their slipping by each other.

C. H. WILCOX.

A Wire Cutting Lathe Attachment.

Editor American Machinist:

The wire cutter here shown was made for use on an engine lathe to cut handle rivets, stop pins and pins for various other purposes, and of which our work requires a large number. The chuck *A* fits the spindle of a lathe. An eccentric beveled disk or cutter *B* is fastened to the chuck. An angle plate *D* is bolted to the cross-slide and in the vertical part of it is secured by set-screws a hardened bushing and an adjustable length gage. The face of the bushing is somewhat convex and that of the disk slightly concave. The hole in the bushing makes an easy fit for the



A WIRE CUTTER.

stock to be cut, and there is a separate bushing for each size of wire.

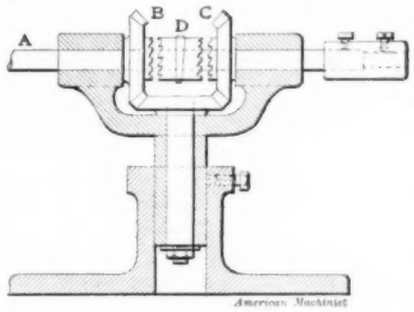
After setting the stop to the proper length, the operator inserts the stock in the bushing and starts the lathe. The disk swings past the bushing with a sliding and advancing cut, and off comes the piece without shock to the machine or burr on the stock. While the cutter is finishing its revolution the stock is again advanced to the stop, and so on. On the fastest gear speed we are able to cut about 2,400 pieces per hour from 3-16 inch mild steel stock. The cutter will last a long time without regrinding, as the angle-plate can be moved in or out by the cross-slide, thereby bringing the cut on a new part of the cutter, and thus utilizing a large part of the circle. Its small first cost, ease of maintenance, speed and smoothness of action make it an efficient and desirable lathe attachment.

ROGER HAINES.

A Handy Tapping Attachment.

Editor American Machinist:

While passing through an old shop in New Hampshire recently, my attention was caught by a tapping device which may be an old friend of some of your readers, as I was told it had been in use there for a long time, but to the younger generation it may carry a valuable suggestion. Its use is in tapping castings small enough to be



A HANDY TAPPING ATTACHMENT.

held in the hands of the operator. It is designed to take the place of the more expensive special tapping machines and to economize space in small shops.

In operation it is clamped upon the bed of any speed lathe and the driving stem *A* is held in the chuck after adjusting in line with the lathe centers. A bevel pinion *A* is fastened to the driving stem, the other *C* running free upon the tap-carrying spindle, both being connected by an intermediate bevel gear on a little vertical shaft. A double-faced clutch is fastened upon the tap-carrying spindle, alternately engaging the clutch teeth on the inner hubs of the bevel pinions. Pushing or pulling on tap determines which way it shall turn.

WINFRED C. RODGER.

Providence, R. I.

Patentable Usefulness.

Editor American Machinist:

Referring to the use of sulphur in the blacksmith's fire, it appears from Mr. Jones's letter, page 1239, that there was one blacksmith at least who found it, or thought he found it, of some use. It also appears from his letter that he is of the opinion that there are still blacksmiths who will want to use sulphur in that way, because he asks anxiously whether it can be possible now to stop anyone from so doing, meaning on account of the patent which you noticed on page 1088. So you see that it would have been quite beyond the province of the Patent Office to refuse to grant the patent on the ground that the process claimed was not "useful." There was apparently no evidence, either in prior patents or publications, that throwing sulphur in the fire previous to heating the metal therein was harmful or of no use. Besides, such a question is always a matter of opinion. Some blacksmiths would declare it to be of no use, while others, like Mr. Jones's friend, believe it to have a beneficial effect. In such a case the inventor, who believes in his process sufficiently to pay the fees for a patent, must be given the benefit of the doubt. There is no legal ground for the refusal of a patent under such circumstances. Of course if an instance of prior public use, such as Mr. Jones tells about, could be proved, the patent would be invalid.

As a matter of fact, the claims originally presented were rejected on the ground that sulphur in the fire performed the same function as sulphur placed on the surfaces to be heated, which was shown to be old. When, however, the applicant amended by stating that the effect was not the same, also by substituting a claim slightly differing, in language, from the original ones, the case was allowed, because it could not be shown from any published matter accessible to the examiner, that the effect was the same, or that the effect was not beneficial. It is a hard thing sometimes to prove a negative, Mr. Editor, and there are nearly always two sides to a question, and your article (page 1088), headed "Another 'Useful' Patent," seemed to me rather one-sided; hence the above attempt to show the other side.

HOWARD A. COOMBS.

Washington, D. C.

Centering Eccentric Mandrels.

Editor American Machinist:

In making a mandrel for turning eccentrics it usually would not be difficult to lay off the eccentricity to the required degree of accuracy, provided both ends could be exactly alike. Unless especial care is taken in the centering, the eccentricity will not be quite the same at the two ends and all the four centers will not be quite in the same plane. The mandrel in use will not stand the severe test of facing a large collar on one set of centers and have that side still run true on the other centers. The following simple method may be described as theoretically correct, there being little more than the inaccuracies of the lathe to contend with.

Center and turn up the mandrel and lay off one of the eccentric centers. Drive a large collar on the opposite end, its face flush with the end. Face the collar and

end of mandrel carefully and then bolt the collar to the lathe face-plate by cap screws tapped into the collar and screwed in from the back of the face-plate. The face of the plate must be true. Use an indicator to set dead true the eccentric center on the projecting end of the mandrel, as already laid off. Now drill and finish the center, and before removing from the face-plate turn off the edge of the collar. Turn the mandrel end for end, putting the center just finished on the live center and the turned collar in the steady-rest and put in the other center. It is evident that the face of this collar, turned upon one set of centers will run true during the whole operation of putting in the other centers and that it will be true on either set of centers indifferently.

T. A. B.

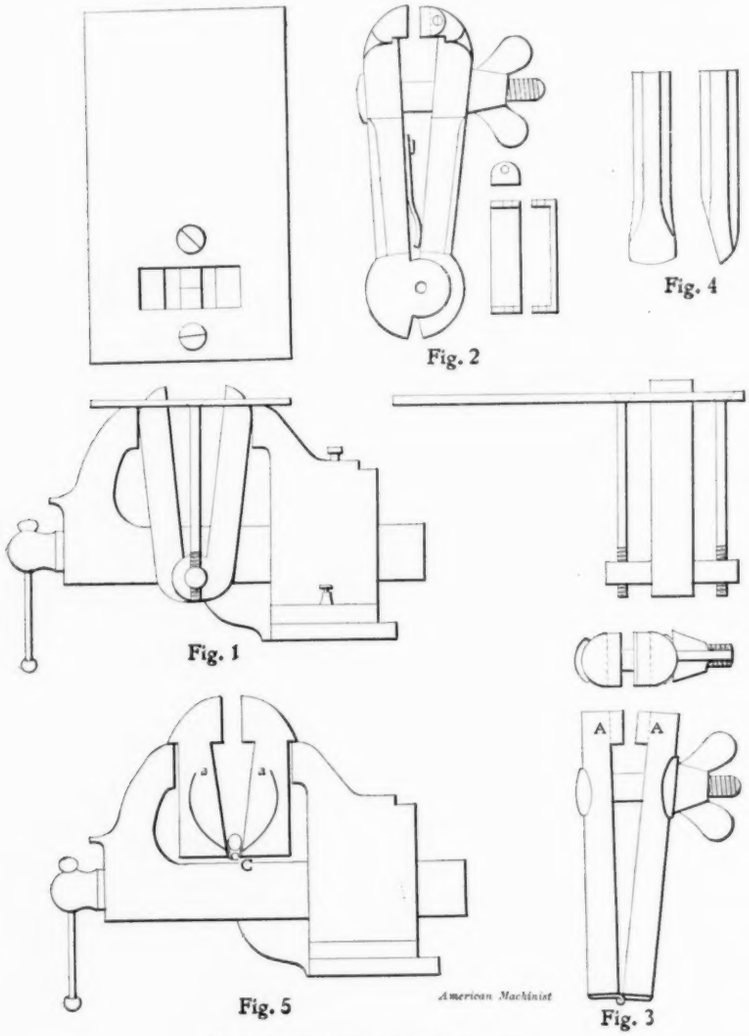
Handy Vise Attachments.

Editor American Machinist:

Phillips Brooks said: "There may be some commendable *vices;* I have never seen one." Fig. 1 shows an attachment for holding thin flat pieces to be filed; the table of sheet steel supports them. The flat pieces to be filed are held between the false jaws, which keep the work from moving laterally while the flat sheet steel supports it. The hole for the jaws is placed near one end so that work can be beveled. The screws raise or lower the jaws for work of different thicknesses.

Fig. 2 is a movable jaw pivoted on two screws. Fig. 3 is a wooden hand vise made by cutting a piece of broomstick through its lateral axis; the faces *A A* are of hardwood glued on. I have tried several kinds of wood, but find holly the most serviceable. Fig. 4 is a chisel used to checker steel like vise jaws, also to cut metal saws. The curved edge is held away from the operator and the first blow is struck on the metal farthest from the operator; the chisel is then brought forward and slid along the work until the rounded edge raises slightly on the burr of the previous cut, then the chisel is struck, and so on until the work is completed. With very little practice the chisel marks will be parallel and more evenly spaced than if they had been ruled first. It is in this way that hand-cut files are made. Fig. 5 is a pair of wooden vise jaws; *a a* is a spring. The two pieces are held together by a common door hinge.

S. AND S.



SOME HANDY VISE ATTACHMENTS.

A Circle Marker for Drilling.

Editor American Machinist:

Speaking of prick punches, or, as some people call them, center punches, you have been publishing some that have been of interest to me, and I thought I would submit one before the subject got to be a chestnut. This one, as shown by the sketch, discards the dividers for striking circles. Of course we would have to have the center of the hole to be laid out for this scheme. Placing the point of the rod in the center and resting the circle marker on the iron, raise the weight and bring it down on the marker, and it will make a circle to serve as a guide for the drilling. All sizes can be made to fit the one rod; the one shown is ½ inch.

A CIRCLE MARKER.

C. W. PUTNAM.

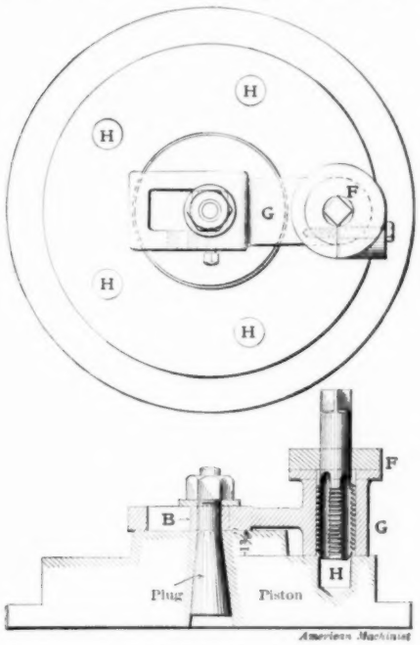
A Tapping Guide.

Editor American Machinist:

We had a way to tap holes perpendicular in the Pushfinger shops, a way that might be imitated with profit at the present day. The sketch shows how it is applied to pistons—"piston heads," we called them. They called them "spiders" in the Murdocksville shop, but that always was a great place for insects. A guide *G* is bored to fit the tap. It is not threaded, although, if it were necessary to have all the threads begin at a particular point, it could be accomplished in that way, but for ordinary work too much time would be lost running the tap in and out of the guide. The top of the guide must be faced true with the hole and a friction collar *F* bored to fit the shank of the tap and also faced to lie flat on the top of the guide. These two parts are the essentials.

To adapt the fixture to this particular job we had a wing cast on the guide bushing and in this wing there was a slot with a sliding block *B*. A center drilled in the side of the block receives the point of set screw in order to acommodate three sizes

of pistons. The central plug was one used to hold the drilling jig in position, so that its cost did not figure in this job. The sliding block is a trifle less in hight than the wing of the guide, to let the washer and nut clamp the fixture. These pistons happened to be all the same hight, 1⅜ inches, so that no adjustment was required in that direction. To use the fixture clamp it over *H*, a hole to be tapped; the taper



A TAP GUIDE.

point of the tap will find the center. Give the tap a few turns and tighten the friction collar. The tap, as it draws itself through the friction collar, follows the line of least resistance, thus tapping a hole at exact right angle to the face. It requires a little more force to drive the tap, but, as our boys had more strength than skill, it suited them exactly and was used for all large taps.

ISAAC MORGAN.

The Penberthy Boiler Explosion.

Editor American Machinist:

I send you to-day a copy of the Detroit "Journal" showing a photograph of the boiler which exploded on Monday, November 25, at the works of the Penberthy Injector Company, at this place. As you probably know, this is one of the worst boiler explosions which has occurred anywhere—particularly as considered from the number of lives lost. Up to this time thirty are known to be dead and several of the injured are still in a critical condition. I examined the boiler this morning as best I could from the way it lies on the ground, and I find that one sheet along the belly of the boiler parted until it reached the seam and then followed the rivets in the other sheet, so that the whole shell spread out from end to end and now lies like a tent over the mass of distorted tubes. The heads also left the tubes almost entirely. I notice the ends of the tubes where they have been broken off since the explosion are burnt and crystallized, but this does not appear to have been the point which gave way first. The staybolts, as far as I could see, were not corroded or weakened and the shell appeared to be about ⅜ inch thick. It is of course hard to form any correct theory as to the disaster from a mere casual examination. As the accident has occurred in the center of a city and resulted in such disastrous loss of life, it will be thoroughly investigated, and if possible the cause of the explosion will be arrived at.

When the boiler exploded it seems to have lifted up against or through the next floor and then settled down, taking the entire building with it, so that in a moment the entire three-story brick structure was a pile of ruins in which were imprisoned probably 100 employees. Many who were caught in the debris were scalded and burnt to death before they could be relieved.

So far no blame seems to attach to anyone of the Penberthy Injector Company or their employees, and it may possibly go down in history as another mysterious explosion. In looking over the ruins I have felt that if the cause of this explosion could not be arrived at and boilers of this type are still going to be subject to these mysterious explosions, it is to be at least hoped that such disasters as this will result in causing such legislation or ordinances to be passed as will not allow such boilers to be placed in the midst of a factory or building filled with people. The above boiler was a plain horizontal tubular boiler.

This disaster brings to mind an occurrence which came to my observation in New York city a couple of years ago. The engineer in a large building happened to pass through the boiler room when the fireman had the doors open and looking in told the fireman that his boiler was red hot. The fireman insisted that it was not, but the engineer as firmly insisted that it was and required him to draw the fire. It was found that oil had gotten into the boiler and formed a deposit on the sheet directly over the fire, causing it to become overheated and belly down 2 or 3 inches over a space of 15 inches in diameter. The probability is that if this engineer had not happened at that moment to see the condition of that boiler there would have been another mysterious boiler explosion which would have been hard to account for.

H. H. LANE.

Detroit, Mich.

Examination for Hull Draftman.

The United States Civil Service Commission, Washington, D. C., announces that on January 7, 8, 9, 10, 1902, an examination will be held at various places throughout the United States for hull draftsman in the office of the Lighthouse Board, at $6 per day.

Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(25) F. H. M. asks: In figuring a crowned pulley, should the diameter be given at the edge or at the highest part of the face? A.—It is customary to give the extreme diameter of the crown, though it is a matter of small importance.

(26) Providence asks: Is there any rule for figuring at what pressure a crank must be forced on a shaft, or a crank-pin be forced in a crank, or is it a matter of judgment and experience? A.—Our issue of July 20, 1899, contained a diagram for this purpose which was the result of the analysis of several hundred cases and is the best practical guide for such work of which we have any knowledge.

(27) B. B. P., Griffith, Ind., asks: What are the relative merits of the round and the flat beads on cast iron pipe fittings as they exist on the market? A. The general practice seems to be to use the round beads for malleable iron fittings and the flat beads for cast iron, the latter of course giving the greater strength for the same outside diameter. We do not think of any other particulars bearing on the "merits."

(28) P. I., Indianapolis, writes: (1) A claims that the tongue or thin part on the end of the taper shank of a twist drill is for the express purpose of driving it out of the socket, while B claims that it helps to drive the drill also, and if it were not for this projection the drill would have to depend on the taper alone and it would stop. A.—The drill would generally drive by the taper alone, but the projection on the end makes it sure not to slip. (2) Are all taps, both hand and machine, relieved on the threads for clearance? A.—They certainly are not. All machine taps should be, and hand taps also, to make them cut easily; but, as hand taps usually have to be backed out of the holes, chips or dirt sometimes will wedge in the clearance and make trouble. The clearance therefrom should be as minute as possible.

(29) F. W. B., Holbrook, Mass., asks: (1) Will a pair of miter gears, accurately cut and whose pitch lines coincide, have any end thrust other than that due to the friction of the teeth engaging each other, and is not that taken in part by the shaft bearings, the pressure on the teeth being at an angle of 45 degrees to the shaft? A.—All gears—spur as well as bevel—have a thrust tending to force them apart, due to the fact that the line of action is not perpendicular to the line of centers. With epicycloidal gears the line of action is perpendicular to the line of centers at the moment the point of contact is at the pitch point but not at other points. With involute teeth the line of action is never thus perpendicular, being inclined in accordance with the angle of obliquity for which the gears are

laid out. With spur gears the thrust is all resisted by the shaft bearings, but with bevel gears it is resolved into two components, one of which acts as bearing pressure and the other as end thrust. (2) Has any rule been found for calculating the end thrust of bevel and miter gears? A.—The friction of gears has been the subject of mathematical investigation which would naturally include this problem. We do not know what results were obtained, and regard such investigations as of limited value.

The Reciprocity Convention.

Editor American Machinist:

Your issue of November 28 is before me and I notice your articles on reciprocity convention. On page 1322, in the third column, you say "There was a long list of resolutions presented to the committee which resolutions never again saw the light," and below you say, "It is fair to say also that a number of resolutions on the other side, *i. e.*, directly opposed to reciprocity, were also pigeon-holed." Both of these statements are in error. The writer has before him a full copy of the resolutions which were read before the convention and which embraces all the resolutions, including Mr. Saunders', that had been received up to the time the committee made its report; subsequently, such resolutions as were handed in later were either read or fully explained to the convention. I think you draw a wrong inference from the resolutions adopted by the convention. It was simply a case of where the opposition was organized and those in favor of reciprocity were not. The interests which considered themselves about to be hurt, especially by the French treaty, by united and intelligent effort accomplished what they had come to the convention for, namely, to see that reciprocity or tariff revision was dealt as severe a blow as possible—in this case "damning it with faint praise." The opposition consisted almost entirely of the "knit-goods industry" and the "jewelry manufacturers," and I do not remember that there was any other strong opposition. I believe it will be violating no confidence to say that there was a decided sentiment in the Committee on Resolutions in favor of a more vigorous set of resolutions, and the resolutions were adopted in the committee on a five to three vote. In your article on Mr. Clark's speech, page 1303, you failed to take into consideration that Mr. Clark knows how to talk to a certain audience which enjoys his remarks, and as that "knit-goods" audience, or part of it, was present in large numbers you need not take it for granted that they did not bestow all the applause he received.

Your articles, the writer thinks, convey the idea that there was practically no sentiment expressed strongly in favor of reciprocity, which is a mistake. I doubt very much if the projectors of or delegates to this convention expected any definite or strong declaration for reciprocity, probably anticipating that the convention would be largely of an educational character. To judge from this point of view, I believe the convention was a success.

MURRAY SHIPLEY.

Cincinnati.

A Correspondence School and Christmas Scholarships.

The American School of Correspondence, "A Technical School for Wage-earners," Boston, Mass., has published a hand book explaining its organization and scope. The full engineering courses offered are as follows: "Electrical, mechanical, mechanical-electrical, stationary, marine, locomotive and textile engineering, heating, ventilating and plumbing. There are also a number of special subsidiary courses. The list of the faculty shows about twenty-five instructors, besides officers and members of the advisory board. A large proportion of these instructors are graduates of the Massachusetts Institute of Technology. This handbook gives an account of the work of the school in detail with a list of the subjects covered in its courses and specimen pages from its books of instruction, examination papers, etc.

Independently of the hand book we are informed that the school has devised a plan by which an employer may give a scholarship to any deserving young employee for Christmas at a nominal cost. The details of the project have not been fully explained to us, but one feature is the gift of a 2,800-page reference library of Engineering Practice to all December recipients of the scholarships.

Some New Things.

A TOOL FOR SETTING STUDS.

A device for setting cylinder and other studs has been recently patented by Leon K. Stevens, of Brooklyn, N. Y. The construction of the device will be readily understood from the accompanying engravings. The adjustable collar *m* rests upon the surface of the work and the stud to be inserted is held in a split nut *b*. This nut is placed within the collet *a* and in a hole which is elliptical instead of round, as shown at Fig. 4. The collet *a* is driven by means of the pin and clutch shown above it. The stud being inserted in the tool, as shown in Fig. 1, with the split nut closed upon it, is screwed down by the motion of the spindle until the collet comes in contact with the collar *m*. Motion then continues until the square pin *f* is drawn down and disengages from the position in which it is shown in Fig. 1, which allows the split nut to stop for one-quarter of a rotation. This brings it into such a position in the collet *a* that it can open, which it does, releasing the stud. Then upon the spindle of the machine being raised the pin clutch at the top of the collet is disengaged so that the collet and split nut can be held stationary for the insertion of another stud without stopping the spindle of the machine.

A NEW SHEET STEEL PULLEY.

The cuts herewith illustrate and sufficiently explain an ingeniously devised scheme for the manufacture of pulleys of sheet steel by punching, bending and electric welding, without any bolts or rivets except the bolts necessary for clamping the pulley upon the shaft, and for holding the halves of the rim together. Fig. 1 is an elevation and section of the pulley, and Fig. 2 shows sufficiently the details of con-

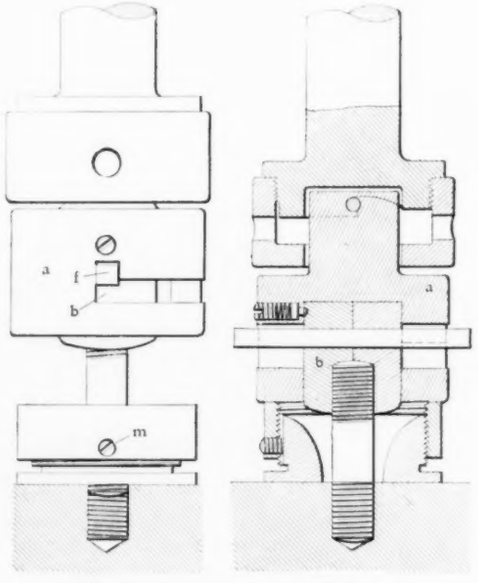


Fig. 1

Fig. 2

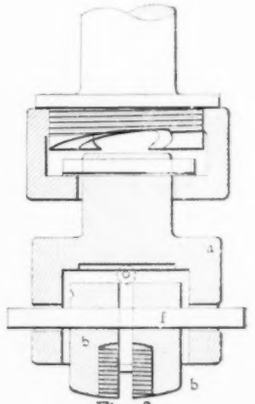


Fig. 3

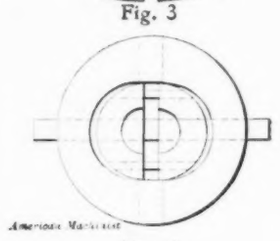


Fig. 4

TOOL FOR SETTING STUDS.

struction. The pulley, as completed, it will be seen, has several valuable features. It is apparently as light as it is possible to make a pulley, and the arrangement of the arms at the outsides of the pulley, instead of in the middle, gives them the double advantage of greatly stiffening and supporting the rim and also of enclosing and guarding the entire pulley so that with its use there can be no possible catching of anything upon projecting set-screws or hubs. The depressions or panels pressed into the flat surfaces of the arms of course greatly stiffen the entire pulley.

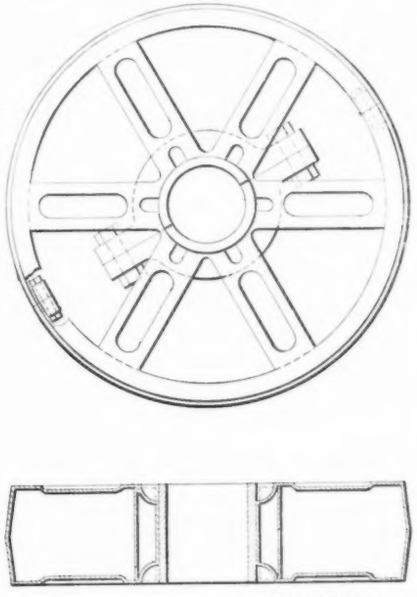


FIG. 1. A NEW SHEET STEEL PULLEY.

The hub and the arms of the pulley are formed of a single piece of sheet metal, the stock for which may be a flat plate, as *A*, Fig. 2, or a portion of a tube, as *B*. Divisions are sheared or sawed between the arms and then they are bent at right angles to the portion forming the hub, the operation of course being done by suitable presses and dies. The rim of the pulley is U-shaped, and the ends of the arms are electrically butt-welded to the inwardly projecting flanges of the rim. In solid pulleys the meeting ends of the rim are electrically welded, but in split pulleys the ends are connected by plates *C* riveted or welded to them. These plates are each provided with tongues, as shown, matching corresponding indentations in the opposite plate. A U-shaped recess formed in each plate provides for the necessary bolts to hold the halves of the rim together. Clips *D* are used for clamping the hub to the shaft, a split bushing being enclosed inside the sheet metal hub. The inventor of this pulley, upon which there are several patents, is Adolph E. Brion, 94 Fulton street, New York city, and we understand that arrangements are being made for manufacturing and marketing.

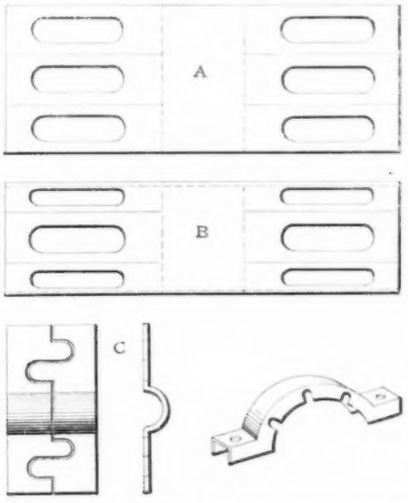
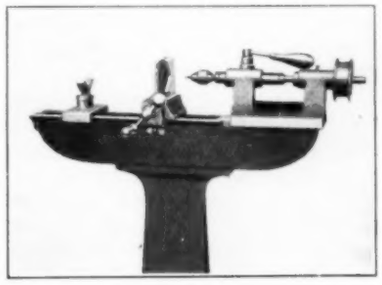


FIG. 2. DETAILS OF SHEET STEEL PULLEY CONSTRUCTION.

A NEW CENTERING MACHINE.

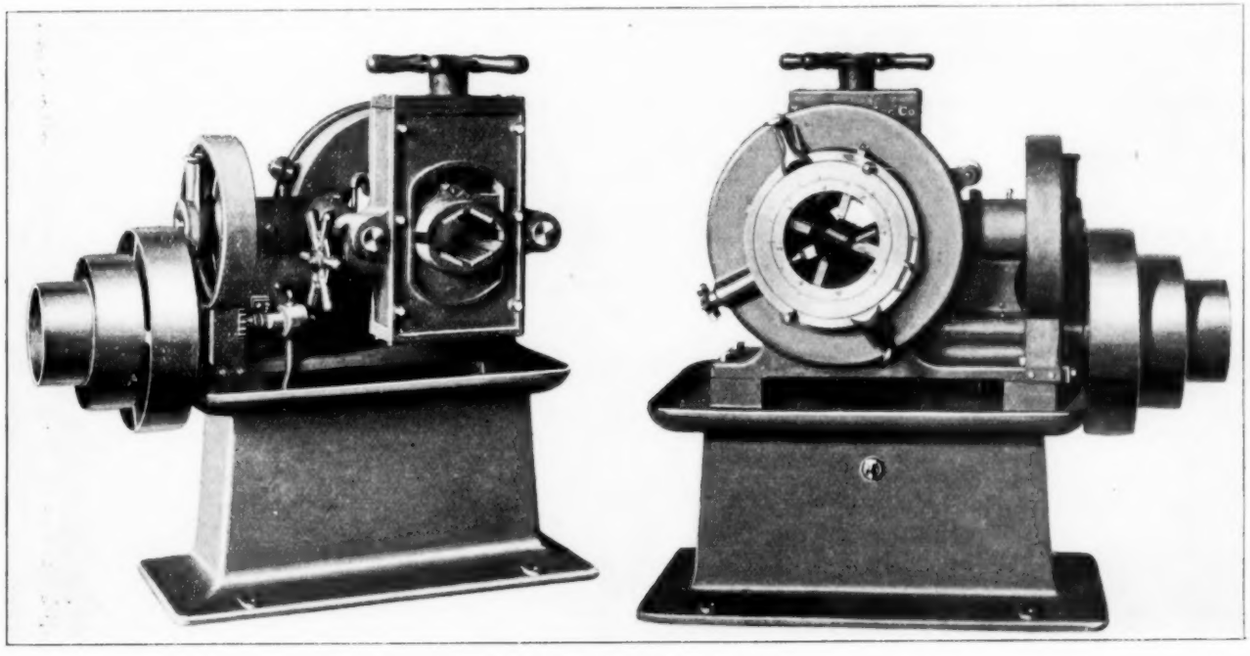
The half-tone shows a new centering machine made by the Phoenix Manufacturing Company, Hartford, Conn. It is a carefully made tool, intended for long durability. It is intended to use the combination center drill and reamer which completes the center at one operation. Reamers are furnished by the makers with shoulders to abut against the chuck jaws, so that there can be no slipping back. The vise jaws have long bearings and will hold centrally, firmly and equally well round, square, hexagonal or octagonal work. A plate with a turned shank may be clamped by the shank in the vise and then the machine may be used as a traverse drill, or an angle-iron may be fastened to the bed for the same purpose. A countershaft is supplied with the machine.



A NEW CENTERING MACHINE.

A PIPE-THREADING MACHINE.

The half-tones show one of a new line of pipe machines built by the Oster Manufacturing Company, Cleveland, Ohio, this machine cutting up to 6 inches in diam-

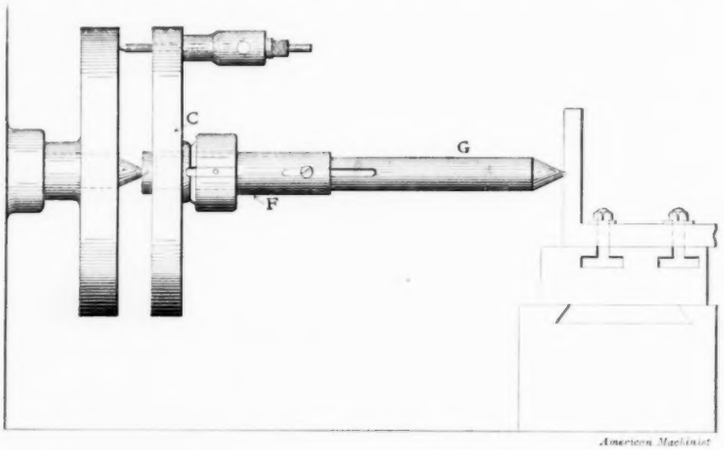


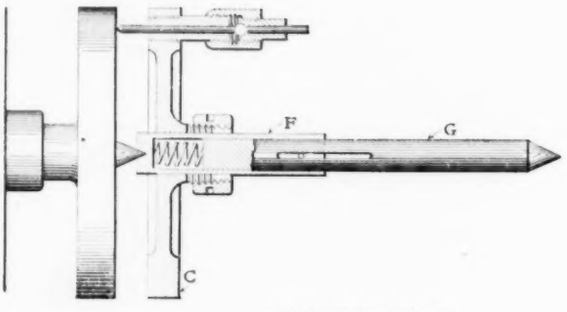
A NEW PIPE-THREADING MACHINE.

eter. It has a ratchet attachment by which it may be operated by hand when necessary. The pipe is gripped, securely and centrally, by the jaws, and a hand-wheel gives the longitudinal movement to feed the pipe into the die or to withdraw it. The expanding die head can be opened while the machine is in motion. The dies are removable through the outer shell. A cam-plate with convenient handles adjusts the dies to size, with a stop to maintain the adjustment. There is an automatic cutting-off arrangement operating a lathe tool by a star feed. A gear-driven rotary pump floods the dies with oil when the machine is in operation, the base of the machine affording an ample oil reservoir. The machine is believed by its builders to be almost "fool-proof."

A LATHE INDICATOR.

The instrument here shown, recently patented by John C. Miller, Bloomfield, N. J., is to be used in connection with a lathe or a milling machine for setting the center of the work or any center or center punch mark on the work in line with the center of the spindle. The operation of the device is evident. The disk *C* has a split hub and a nut by which it is clamped anywhere on the sleeve *F*. The center in the closed end of this sleeve is placed on the center of the machine spindle and the center on the end of *G* is placed in the center of the piece of work to be located, the spring acting to press both centers with sufficient force to hold the instrument securely. Near the periphery of the disk is a micrometrically adjusted pointer and, by turning the instrument around, the contact of this pointer with the face-plate will indicate in which direction the work requires to be moved to correct the setting. Any desirable limit of precision may be observed in the micrometer, and the work may be set with the greatest accuracy.

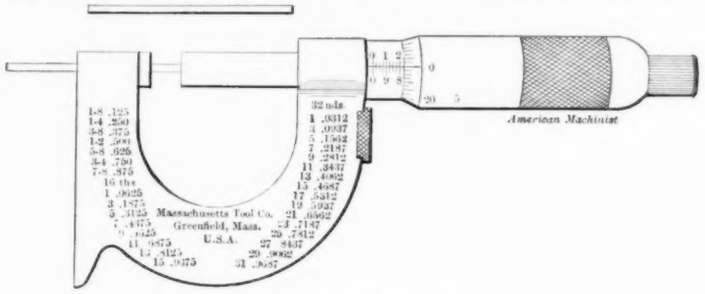




A LATHE INDICATOR.

AN IMPROVED MICROMETER.

The cut shows a micrometer made by the Massachusetts Tool Company, Greenfield, Mass., the special features of which will be easily understood if we merely call attention to them. It will be noticed that the frame has the end carried out in a straight line and accurately ground. This enables the instrument to stand alone, which is often a convenience, and with the use of the little rod slipped in through the hole in the anvil and abutting against the micrometer screw it constitutes an efficient depth gage. With the rod removed the instrument may be used in the usual way. In addition to the usual facilities this instrument has double graduations, reading both ways, round end shell and depth plug attachment for measuring holes, slots, keyways, shoulders, etc. It is also fitted with a patent locking device.



AN IMPROVED MICROMETER.

We have received from C. Huber & Co., Karlsruhe, Baden, a reprint or supplement from the "Zeitschrift des Vereines Deutscher Ingenieure," consisting of an article (in German), by Prof. A. Riedler, on the Huber system of hydraulic high-pressure press and stamp work, applied on all sides. It is a copious article on the subject and contains numerous illustrations of the apparatus and the work accomplished. This process we take to be substantially the same as that employed by the Gorham Manufacturing Company, which was mentioned on page 796.

"What is your occupation?" asked the attorney.

"I haven't any," the witness answered. "I work in a boiler factory."

"Well, don't you call that an occupation?"

"No, sir. I call that a job."—Chicago "Record-Herald."

"The Automobile Magazine" for December is a particularly interesting number with its account of the automobile show in New York, the hill-climbing contest at Eagle Rock, and other matters of interest to those who build or who use, or think of using, an automobile. Under the editorship of Malcolm W. Ford, late secretary of the Automobile Club of America, the magazine has steadily improved. The offices of the publication, as well as those of "Railway and Locomotive Engineering," have been moved to No. 174 Broadway, New York.

Obituary.

Edward Joslin died at Keene, N. H., November 21, ninety-one years old. Mr. Joslin was a pioneer manufacturer of wood-working machinery. He is said to have made the first mortiser, the first tenon machine and the first wood molders. In 1830 he established, with J. A. Fay, the company which is now the J. A. Fay & Egan Company, of Cincinnati. Mr. Joslin was for many years the head of the firm, directing its affairs from Keene.